

October 31, 1960

Aviation Week

and Space Technology

**GE Data Link
May Speed SAC
Communications**

**United Aircraft
Ion Engine**

75 Cents

A McGraw-Hill Publication



SOLID-PROPELLANT ROCKET POWER

by Aerojet

Storable, unignitable, ready to a rifle bullet—that's today's solid rocket engine. Since 1949, Aerojet-General has delivered over 70,000 solid rockets to the Armed Services, with an average engine reliability of more than 99.95%.

In the states, as in the forces, Aerojet stands foremost in the solid rocket field. Our Solid Rocket Plant near Sacramento, California, is the nation's largest facility for the development and production of solid rocket power plants.

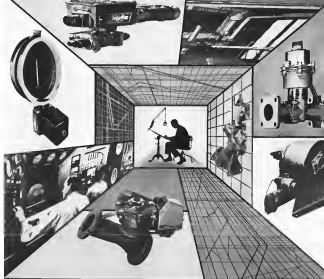
With a propellant capability measured in millions of pounds per month, the Solid Rocket Plant is providing reliable rocket power for the nation's major missile programs.

POLARIS
MINUTEMAN
HAWK
SCOUT
SKYBOLT
EAGLE
SHARROW
TARTAR
GENIE

Solid Rocket Plant

Aerojet-General
CORPORATION

Sacramento, California



Why pneumatic control engineers bring their "tough" valve problems to Hydro-Aire

They've been here before. They know Hydro-Aire designs reliable pneumatic valves and delivers on time. So, they come back. It's that simple. How we do it is no secret. We stress design simplicity, apply criteria based on more than 10 years' solid experience. Our Pneumatic Test Lab works with industry's best. Our plant is specialist-staffed to get the job done (1) right and (2) on time. Performance is proof. Try us. Our new Pneumatic Equipment Catalog describes current, qualified production designs for operating pressures to 3600 psi, opening temperatures to 1800°F and 500°F ambient. Write on your company letterhead for a copy.

ENGINEERS Write O. B. Robinson, Chief Engineer, regarding service opportunities at Hydro-Aire.

HYDRO-AIRE
VALVE DIVISION, AEROSPACE
DIVISION, INDUSTRIAL
DIVISION, AUTOMATION
DIVISION, SPECIALTY
DIVISION, GENERAL
DIVISION, SPECIALTY

DIVISION OF **HYDRO-AIRE** CO.

HIGH CLAMP-UP MEETS MACH 2 STRUCTURE NEEDS

hi-Lok

Faster the speed, more varied the mission...the more critical are the structural requirements. Such is the Navy's newest all-weather, nuclear weapons carrying aircraft...the carrier-based A3J Vigpatric.

Because of their excellent residual preload characteristics, Hi-Loks were selected for use throughout the A3J primary structure. The unique Hi-Lok torque-off feature produces a high, uniform clamp-up of high tensile sheet materials in all grip conditions. The installation method is smooth and quiet, inexpensive, lightweight, Hi-Lok tooling reduces worker fatigue and avoids the need for heavy equipment or bulky pull-type equipment and their limitations in close quarters. In open areas, Hi-Loks can be installed at speeds up to 45 per minute.

Write or contact us for Hi-Lok technical and specification data.

hi-shear CORPORATION

4000 WEST 40TH STREET TORRANCE, CALIFORNIA 90503

RIGHT: Here Hi-Loks are being installed in the A3J rear fuselage with Hi-Lok right angle tooling attached to a fixed tool holder. Other Hi-Lok angles tooling is available in straight, 45° bent and offset styles to overcome difficult or tight clearance conditions, resulting from the unusual structural configurations of high performance aircraft such as the Vigpatric.

© 1980 TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO. ALL RIGHTS RESERVED. TIMKEN, TIMKEN LOGO, AND TIMKEN ROLLER BEARING COMPANY ARE REGISTERED TRADEMARKS OF TIMKEN ROLLER BEARING COMPANY.



ABOVE: Its strength and temperature range, the A3J rear structure shows Hi-Lok pins (275,000 psi shear or 275,000 psi tensile) with shanks made to 5005 aluminum with standard oval collars. These Hi-Loks can be used to 400 F. Other primary structure uses alloy steel Hi-Loks and 50,000 psi shear or 100,000 (50,000 psi tensile) with shanks made to 5051 steel as well as heat lengths to 100,000 inches.



within 24 hours

any day is the right day

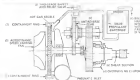
to order your Timken® 52100 steel tubing, and within 24 hours of receiving your order it will be on its way. To give you this fast service on less than mill quantities, we stock 101 sizes—from 1" O.D. to 10½" O.D.—in a new, modern warehouse. And the same fast service is available on 50 sizes of 4620 tubing. You can save time and money by remembering that 90% of all your structural parts can be made from one or the other of these two steel analyses. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.

TIMKEN®
Fine Alloy **STEEL**

A major advance in safe
three-way turbine
engine starting



Sundstrand Cartridge-Pneumatic Starter



Automatic starting sequence includes features. The low-inertia valve provides 100% flow, 100% in cartridge start rate and accurate compressor starting. Design is air intake valve is 100% 100" x 100" F. The early stage of the valve opens automatically.

Pneumatic and electrical protection against
failure during starting and operation

	Detected	Protects	Engine operation
(1) Speed Overload	■	■	■
(2) Delay and Start Valve	■	■	■
(3) Speed Limiting Valve	■	■	■
(4) Overrunning Valve	■	■	■
(5) Speed Control	■	■	■
(6) Automatic Stop	■	■	■
(7) Emergency Stop	■	■	■
SAFETY			

The new universal Sundstrand Cartridge-Pneumatic Starter incorporates the most comprehensive fail-safe system ever designed for cartridge, ground cart compressed air, and engine-driven air turbine engine starting. Complete protection against destructive failure, as illustrated above, ensures the safety of personnel and aircraft.

Fast to cartridge start the TF-33 ducted fan engine for the B-52H, the starter also has been proved on the J-57 and J-79 engines and is readily adaptable to J-52 and J-79 engines. Its universal design makes the start

completely interchangeable for retrofit on the F-100, F-101, F-105, KC-135, and the B-52 series, replacing pneumatic starters. With minor change this universal designed starter is adaptable to the F-104, B-58, and GAM-77 Hound Dog.

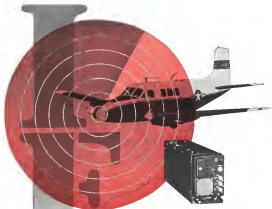
The Cartridge-Pneumatic Starter is backed by Sundstrand's experience and capabilities as the nation's leading supplier of aircraft secondary power systems. Detailed information is available upon request. Call our nearest office or write to the address below.



SUNDSTRAND AVIATION

DIVISION OF SUNDSTRAND CORPORATION • ROCKFORD, ILLINOIS

Division Offices in Arlington, Texas; Hawthorne, California; Rockford, Illinois; Dayton, Ohio; Seattle, Washington; Stamford, Connecticut; Washington, D.C.



Any time...any place...any mission

wilcox-developed AN/APX-44 TRANSPONDER safeguards Army aircraft

Now being installed on U. S. Army aircraft, the AN/APX-44, designed and produced by Wilcox Electric, provides reliable TF, 2F, and AIC functions during any mission.

The AN/APX-44 automatically transmits specially coded identification pulses when subjected to radar interrogation. These pulses identify the Army aircraft as friendly and provide ground and airborne interrogators with position data, aircraft description and other helpful information. This transponder also reinforces primary radar replies to permit reliable tracking of the aircraft at extended ranges, despite conditions of minimum weather, ground clutter and dense traffic.

Wilcox has produced these airborne units in quantity and on schedule for Army installation.

The AN/APX-44 features minimum size and weight, modular case structure, a crystal-controlled receiver and cavity-tuned transmitter. It is indicative of the electronic systems capabilities and experience of Wilcox.

wilcox ELECTRIC COMPANY, INC.

Fourteenth & Chestnut Sts.,
Kansas City 27, Mo., U. S. A.



Hiller 12E sets altitude record, lands and picks up payload at 15,000 ft.



12E, first light helicopter to land entire aircraft, 42' pitch, at 5,000 ft.



12E, 1st. of machinery to transport man & 2,000 lb. payload.



12E, 1st. of machinery to transport man & 2,000 lb. payload.

For only weight to make the full climb.



12E, 1st. of machinery to transport man & 2,000 lb. payload.



12E, 1st. of machinery to transport man & 2,000 lb. payload.

THE ARMY GROWS 'EM TOUGH

Now the Hiller 12E becomes first choice of Commercial Operators

From the day it went into commercial service the Hiller 12E had a head start. It had an Army-proved H-33D engine and an Army-proved H-33D drive system that hadn't begun to exploit its full strength.

The real step towards the space on wheel light utility helicopter can do. Capitalizing on the H-33D's proven engine's power, light helicopter "12E" of the kind above were found to be the most economical helicopter purchase today.

That's why the 12E has become first choice—it's the most economical helicopter purchase today.

Designs are one thing. Deliveries another. Both come down.

HILLER
AIRCRAFT
CORPORATION

PAID ALTO CALIFORNIA WASHINGTON D.C.
Aircraft Registration Division (See chart)



H-12D 120 hp



H-12E 210 hp



H-12A 210 hp



Super E 210 hp



marks the trouble spot in seconds!

Xeroradiography cuts x-ray inspection time and cost! With this revolutionary method, radiographs are obtained electronically—images dry and ready to read less than a minute after exposure. A characteristic phenomenon called "highlighting" automatically emphasizes discontinuities—will show up defects inconceivable by other means. Here at last you find both radiographic detail and high exposure speed rolled into one!

Xero(radiography) is beyond doubt the long-awaited answer for many industries seeking fast, economical production-line x-ray inspection. Proved applications range from tire manufacturing to the production of extruded metal tubing, and it is pre-

viously valuable in the foundry for inspecting light alloys. One prominent aircraft manufacturer reports 25% cost savings with xeroradiography and is strongly urging its vendors to use it.

For complete details on xeroradiography, contact your local G-E x-ray representative now... or write to X-Ray Department, General Electric Company, Milwaukee 1, Wisconsin, for Pub. WA-364.

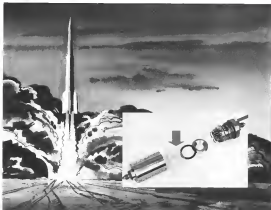
*Notes available on request.

Progress is Our Most Important Product

GENERAL ELECTRIC



THE RAW MATERIALS OF PROGRESS



KEL-F® Plastic... proved reliability for tough pressure assignments

Withstanding vibration... resisting acceleration... extreme temperature variation—these are factors Niandco Engineering Company, Pasadena, California, is meeting in their differential pressure package for service media with the help of KEL-F Brand Fluorocarbon Polymers.

Used in pistons, these package maintain the differential flow of highly corrosive media, such as red and white fuming nitric acid and oxygen. The package operates efficiently between 0°F and 500°F, with a sensitivity change of less than .05% for a 100°F change in temperature. The diaphragms (arrow above) are made of KEL-F Plastic and used by Glau Chemical Corp., a subsidiary of Elvan Products Co., Whittier, California. The damping fluid is KEL-F Brand Light Oil #1.

KEL-F Plastic was chosen because it is chemically inert, thermally stable, has high impact, tensile and compressive strengths, and zero moisture absorption. The unique combination of features, plus others such as easy moldability, makes KEL-F Plastic ideal for many uses in aircraft, rockets and missiles. Included: Gaskets, LOX lip seals, valve diaphragms, fuel nozzles and fuel lines.

KEL-F Brand Gels, Waxes and Gossams, too, have remarkable properties. They can include: Compressor elements, diaphragms, seals, hydraulic and pump seals and liquid bearings.

For complete performance characteristics, write today: specifying area of interest to: 3M Chemical Division, Dept. SAT 330, St. Paul 8, Minnesota.

*KEL-F is a Reg. T.M. of 3M Co.

MINNESOTA MINING AND MANUFACTURING COMPANY

... WHERE RESEARCH IS THE KEY TO TOMORROW





WHY THE RYAN APN-122(V) GROUND VELOCITY INDICATOR IS THE FINEST, MOST WIDELY USED DOPPLER NAVIGATOR IN THE WORLD

Adaptable for nearly every type of aircraft, the Ryan APN 122(V) continuous wave Doppler system provides instantaneous and continuous display of ground speed and drift angle in self-calibrating without reliance on ground or celestial aids. Here are some of the advantages that make this Ryan radar system the most advanced precise means of aerial navigation.

- Ryan APN-122(V) is adaptable, thoroughly precise in flight and in test operations.
- Works with T-66222 and also a 1000 spot frequency.
- No sea altitude or altitude index.
- High accuracy (within 10%) at all altitudes from 0 to 50,000 feet and over seas and weather (due to weather).
- No atmospheric altimeter dependent during operation, barometric and laser.
- Operates in the approved frequency range (3.4-3.5, 11.4-11.5 MHz).
- Broad range: 50-1000 knots and 100-1500 knots.
- Fast time processing system.
- Simple suitable for existing control unit.

APPLICATIONS OF RYAN APN-122(V) NAVIGATOR

ANTI-SUBMARINE WARFARE • PRECISION BOMBING • GENERAL NAVIGATION
RECONNAISSANCE • AERIAL PHOTOGRAPHY • AERIAL SURVEYS • AEROCLOGY
AIRBORNE EARLY WARNING • RADAR SCRAMBLING • INERTIAL DUMPING

EASILEST GROUND SPEED
WITH ANY 1000 SPOT FREQUENCY



RYAN OFFERS CHALLENGING OPPORTUNITIES TO ENGINEERS

RYAN ELECTRONICS

DIVISION OF RYAN AERONAUTICAL COMPANY • SAN DIEGO, CALIFORNIA

* instalelectronics

* NATION-WIDE, ON-SITE ELECTRICAL-ELECTRONICS INSTALLATION SERVICES

Lord Electric's instalelectronics personnel specialize in "putting together" electrical-electronic systems in the field.

This service fills a gap in the long progress from systems design to final operability. Lord's support on the instalelectronics portion of your program can add valuable strength to any proposal, speed completion, enhance reliability ratings.

With experience comprising more than \$1 billion in completed contracts in 36 states and Puerto Rico. This includes a wide variety of important defense installations, from huge atomic facilities to current ground support systems (as much as 3,000 miles apart).

Lord's capability in the electric-electronic phases of field installations extends from planning stages through execution, to final check-out and subsequent maintenance. This capability encompasses:

- Positive Reliability
- Organizational Planning
- Scheduling and Work-Phasing
- Nation-wide Manpower Reserves
- Quality Control Procedures
- Cost Control Procedures
- Work-scheduling
- O & I Record-Keeping
- Contractual Practices and ASER

Are you planning system installations? Lord's instalelectronics support can be a source of strength and confidence on your next proposal.

LORD

ELECTRIC COMPANY, INC.

New York Boston Pittsburgh Portland, Ore. Richland, Wash. San Juan, Puerto Rico



6000° F.

Ball Plaster casting—A major development in production heat resistant alloys. Tempering (usually long to pull in at site) allows off stress cracks and cracks. Some time later the valves, all associated light and ground equipment in electric testing has been pulled back to show Corrosion Plug after after exposure to 6000° F.



5000° F.

Graphite melting resistance—Graphite resistant to handling of gas impregnated graphite fibers in new wear systems in welding design (graphite) suitable for high temperature and electric applications. No melting, and correct and heat tube resistance. Withstand form of solid projected material.



1750° F.

Metalized heat-reflective laminates—Improved mechanical properties continue the reflectivity of thin (0.001-0.002 in.)—100% aluminum coatings with high strength and thermal resistance of reinforced plastics. The principal heat exchanger applications: Motors, compressed air valve protection, exhaust heat damping. Shows typical compound exhaust part.



650° F.

Silicon laminates—Recent improvements in processing now allow the designer to take advantage of the inherent excellent strength properties under high heat and oxidation. Its advantages over of recent trends: new and old cases, fuel, oxidizers, abrasives and thermal rings. Shows module test case.



600° F.

Alumina laminates—High strength and good electrical properties at high temperatures. Alumina with highest strength and stability and low modulus of expansion make the ceramic materials useful in design of deflection. The ML-1 (ML-1 and ML-2) laminates (the ML-1 has the ML-2) showing excellent design of deflection. Shows module design block, and valve.



450° F.

Alumina laminates—High strength and good electrical properties at high temperatures. Alumina with highest strength and stability and low modulus of expansion make the ceramic materials useful in design of deflection. The ML-1 (ML-1 and ML-2) laminates (the ML-1 has the ML-2) showing excellent design of deflection. Shows module design block, and valve.

Swedlow: new advances in solving

THE SPACE AGE HEAT PROBLEM

Improved basic heat resistant materials are only as useful as the ability to combine and fabricate them into useful parts. Swedlow research is improving that ability to an extraordinary degree. Swedlow skills embrace

the above and many other advanced materials. They are available with a wide variety of filler materials, in flat sheet laminates or complex molded contours. Your difficult problems in design and producibility will be welcomed by

Swedlow engineers. Send for full information, Dept. 10

Swedlow

DEPT. 10, NEW JERSEY 20, CALIFORNIA • HONOLULU 9, HAWAII

Some Problems Ahead

The next President of the United States will inherit in a few weeks a heavy agenda of unsolved problems in the national defense area. Most of these are the result of technical complexity and chaotic management in the past few years, but some of them will be solved the product of the technical and political environment we now entering. Both types of problems will have to be tackled by the new chief executive and his cohorts with considerable more vigor, technical literacy and skill than has been demonstrated by their predecessors if this country is to maintain its position as a positive force in the decades ahead. For, given the political and technical requirements now available to all of the major contenders in the international arena, we cannot maintain or improve our position automatically by relying heavily on our past momentum. Achieving this objective will require not only more effort but considerably better direction and management of this increased effort.

The failure of the past decade and three years both Democratic and Republican political leaders, new and old, decreases in our technical skill, industrial capacity or military leadership. Indeed, wherever an executive or legislative permit light has been flashed, the technical progress achieved in specific areas in an allotted time span has been phenomenal.

This has been the failure of our highest level leaders to recognize and understand the nature of the technological revolution that has altered the world in the past decade and the failure to properly organize and direct our technical, industrial and military resources toward the national goal that this revolution made mandatory for survival in the future.

The problems facing the new President in the defense area fall into two broad categories: these immediate problems that have become acute through specific weaknesses during the past few years, and those long-term problems that require development of new national strategy consistent with the industrial revolution and our political goals and require the fundamental reorganization of the management pattern of our military system and its relationship with the scientific and industrial complex on which it depends for the advanced technology.

In the first category, the most acute problem is undoubtedly that of adequately providing for a continuous airborne alert for a significant portion of Strategic Air Command's B-52 fleet. Some steps have been authorized in this direction, but their scale is so small as to be almost meaningless in creating a genuine airborne alert capability for the critical years when it will be needed most. This is an area where immediate improvement is possible through simple fixed and executive action. Unfortunately, not all of the defense problems present such a clear-cut opportunity for swift and decisive action as does the full implementation of SAC's airborne alert capability.

Another immediate decision that must be made is the determination to proceed with the development of operational space systems in all of the areas where they have already demonstrated their technical feasibility, such as communications, weather, earth viewing and a variety of reconnaissance methods. While research and development in these areas has recently been accelerated after a nine month campaign of heavy pressure on the White House by the Congress, military, press and public, there still has been no decision to move into an operational system in any of these vital categories. No matter how swift and successful the research and development phase of these programs is and the progress may have been tremendous—the payoff in operational systems is being needlessly delayed by the lack of an executive decision to move into all of the other areas required to put into service and maintain an operational space system for any of these above named purposes. Here again is an area where a single, clear-cut policy decision often the prospect of substantial dividends in significant achievements within the most critical years ahead.

There are other areas where quick decisions are required to accelerate, expand and sustain progress at such a rapid pace. The new President can hardly delay beyond May 9 to begin preparing to exercise his first powers of decision in the new year.

But the most complex and most serious problems lie in the long-term approach to effective management of our defense resources and their continuous tailoring to an evolving pattern of modern strategy, rather than constructing this technology in the pattern of belated-looking military traditions. This country certainly has the scientific skills, the industrial capacity and military vision to lead any international technical race by a continuously significant margin. But no nation can afford to squander these resources indiscriminately on a system that does not transform new technology into effective support within a reasonably short time span.

We are not now getting \$40 billion worth of effective defense for the annual expenditure in the field, and more money is certainly not a panacea for effective solution of the defense problem.

One of the biggest obstacles to effective management of the defense effort has been the rather naive, off-the-shelf view, regarding top defense officials to direct themselves or an assumed interest in a military organization, that have effectively buried most data with expensive and proven ability in the defense area from participating in the low levels of its management. These flaws have resulted in a steady stream of unfulfilled strategies being rejected in short term losses at the highest management levels of the defense effort. It should be obvious to most that a two year lapse of absence from a soap factory is not a satisfactory method of receiving top level in-flow defense managers.

—Robert Hiltz



Here is the amplifier when distance is a critical factor in obtaining usable signal levels at the receiving station. It is Tele-Dynamics' Type 1114—a new compact rf power amplifier weighing only 14 ounces, for missile, probe or satellite transmitters to give the final boost for good signal reception.

Performance of Type 1114 is reliable and impressive. When used in conjunction with Tele-Dynamics' 1904 transmitter it delivers 15 watts power output with 250 volts at the plate. It is easy to drive and requires no auxiliary cooling system.

This miniaturized model is completely shielded, provides tuned input and output, has excellent load-line characteristics and is ruggedly built throughout to operate with complete reliability under severe environmental conditions.

You can get this new amplifier in two models, for

either 6.3 or 28 volt filament—each available with either integral output filter . . . integral output filter plus integral line filter . . . or without any filter.

The 1114 is ready for immediate delivery. Detailed technical bulletins and evaluation models are available. Please call the American Bosch Arma sales office in Washington, Dayton or Los Angeles. Or contact Tele-Dynamics Division, American Bosch Arma Corporation, 5000 Parkside Avenue, Philadelphia.

American Bosch Arma Corporation is Tele-Dynamics Systems and Components

Communications • Radar • Electronic Warfare • Police • Weather
Instruments • Guidance Systems • High Power Amplifiers •
Transmitters • Power Amplifiers • Receivers • Oscillators •
Recombinators • Receiving Systems • Antennas •
Guidance Systems

TELE-DYNAMICS

AMERICAN BOSCH ARMA CORPORATION

with the help of
CTL's Pebble Bed
Heat Exchanger

Heat-sensitive elements in your space vehicle problems can be located by calling on the expertise and facilities of CTL—builder of the first full scale re-entry vehicle. CTL's Peabody Deep Heat Exchanger simulates Mach and heat flux environment through the entire IRBM-ICBM-space vehicle re-entry range. • CTL's thermal experts will give you comprehensive data on all types of ablation or transportation materials—effective heat of ablation, apparent thermal diffusivity, rate of ablation, free stream enthalpy, endothermic or exothermic characteristics.



Speed your thermal shielding projects to efficient conclusions. Call or write for full information on CTL's thermal testing capabilities.



WHO'S WHERE

In the Front Office

James M. Hunt, president, Food Machine
ry and Chemical Corp., San Jose, Calif.
Harlan Ray, board chairman, Starbuck
America Corp., Dallas, Tex. Also Wynton
Cuthbertson, president, Service Division,
George M. Johnson III, president, Devel
opment Division and Jack Moser, control
manager.

Beverly S. Shandone, a director British European Airways. Mr Shandone is the company's chief executive.

Samuel J. Solomson, president, National Arabians Club, Washington, D. C. Mr Solomson is a president of the Arabians Enthusiast Group.

C. H. Fuller, president Irving Air Chute, Co., Inc., Lexington, Ky., awarded Linda L. Irwin, now board chairman. Also E. W. Smith, executive director of the company's Research and Development Laboratory, Glendale, Calif.

Clarence H. Skipper, president, C28 Fly
trains Danvers, Mass., a director of the
Columbia Broadcasting System Inc.

James E. Weston, vice president engineering, Hydro-Comp & Government and Industrial Group, Philadelphia, Pa.

Charles E. Backus, Jr., Control Regions vice president (Drexel (West) Automotive), a division of North American Automobile, Inc.

Robert L. Swickman, vice president and
chief, Service Corporation of America
Washington, D. C.

William H. Conkleton, a vice president American Research and Development Corp., Boston, Mass.

Dr. Donald W. Collier, vice president research, East-Warner Corp., Chicago 18
Eugene E. Brundage, Jr., vice president

William E. Stone, vice president,
Air Carrier Service Corp., Washington
D.C.

Charles H. Russell, assistant, Ontario

Electronics and Instruments, Inc., Tulsa, Okla. and Wallace C. Thompson, vice president, development, same.

John E. Kucenas, vice president, research and development, General Electric Corp., parent company of Center Electronics and Instruments.

John C. Campbell, vice president of the
ing the Frost G. Hough Co., Edinboro.
25. Also Keith W. Campbell, chief engi-
neer, same.

Ray M. Fisher, assistant to the president, Ohio Council of Business, Inc., Dayton.

Harold R. Logan, formerly deputy comptroller for health of the Department of

under the budget of the Department of Defense now use present planning and programming for Civilian Air. Mr. Nils G. S. John, M. B. B. & B. Co., Inc., New York, N. Y.

Post 34-1 John H. Koch, formerly Director of Budget for Ford, will assume Vis Leger's duties as acting deputy controller.

Brig Gen. M. D. Adams, deputy director of system development, deputy chief of

Also, Rep. Gen. T. C. Redwell, Jr., was named USAP Newbury Medical Center

(Continued on page 104)

INDUSTRY OBSERVER

• North American Aviation is conducting a company-funded study of a solid propellant air-launched ballistic missile for the Mark 7 B-70 bomber. Effortful adaptation of the Douglas Skybolt ALCM to the B-70 would require extensive redesign, close to development of a second generation weapon.

► Chate survey system projected for Air Force Ballistic Missile Division's advanced E-6 version of the Soma reconnaissance satellite capable will have to incorporate guidance capability for extended latencies to a prescribed survey area. Air is already working on one development, and Northrop's Ballistic Missile Division also is working on a chate survey system.

► Boeing will have its decision on whether to use ground-based command guidance or inertial guidance for its Dms Sem vehicle partly on results of a study by Avco Research Corp. on the comparative reliability of the two guidance techniques.

• Joint venture arrangement for proposals and for handling work in the waste and refuse ground support field are under discussion by International Telephone and Telegraph Corp. and Food Machinery Corp. This would combine ITT's repair capability and Food Machinery's mechanical and hydraulic capabilities.

► NASA has decided not to include a changeover in the last Little Joe launch of a Minotaur capsule. Changeover attempts are being trained at Air Force Missile Development Center, Wallops AFB, for launch over Atlantic Missile Range in Redstone-boosted Minotaur capsule flights.

• NASA's S-M0 ionospheric direct measurement satellite is scheduled to be launched Nov. 3 from Cape Canaveral, Fla., with a June 88 release. The \$2.5-3b payload was developed by Goddard Space Flight Center.

► Biomedical officers will be assigned to USAF Support Project Offices, such as B-70 and Delta-Six, under ARDC's leadership of its biotechnology effort. Previously, SPOs have had the services of biomedical librarians but have not had medical personnel assigned directly.

• Helene Severt drove her overseas aircraft sales very evident the past two weeks at the Taurus International Fair, with the Russians scheduling the Mi-4 helicopter, Yak-15 sport aircraft and the agricultural version of the An-2 biplane for display.

■ NASA Lewis Research Center soon will begin a soft-lander landing research program which will include construction of wind tunnel models and test vehicles.

■General Motors' new defense services organization will concentrate at least initially on the weapons detection field. Company may spend as much as \$10 million annually to develop a sensor capability, which was considered too costly for any of its existing divisions to provide out of individual division coffers.

► Strategic Air Command 4th Bomb Wing B-58s have been faster than Mach 2 for a total of more than 75 hrs in two segments of a reflected three hour test flight over the Gulf of Mexico. Longest previous flight above Mach 2 was 18.5 hrs, during a Southeastern World flight.

►Three Kansas H-01B helicopters assigned to Warren AFB, who will remain there after Strategic Air Command completes a study of their potential use for transportation between ICRM missile sites. The H-01B were delivered to Warren directly from the production line.

► Facing 3-12 fitted with dummy Douglas Siskin's ALBMs under its wings will begin a series of local flights from the company's Wichita Division early in December to check aircraft status, controllability.

LIBRASCOPE AIRBORNE COMPUTERS

What goes up must fly true. To maintain this condition, Librascope has packaged the rectangular, polar and spherical geometries of flight...in computers easily held in a man's hand or held aloft by an economic expenditure of power...computers unexcelled for 22 years at calculating flight paths, interception courses, fire control trajectories...with answers that come out fast and right. They offer a challenging capability to alert project engineers. Write to Librascope, 808 Western Avenue, Librascope, A Division of General Precision, Inc. For engineering career opportunities, address Glen Seltzer.



and design engineers. Glendale, Calif. For information on Employment Mgt.



computers that pace man's expanding mind



Washington Roundup

Prestige Debated

U. S. prestige became a major campaign debate last week. Democrats generally took the position that it is not to discuss how while Republicans maintained that it is an all-time high.

Series of surveys made by and for the United States Information Agency because the cost of the argument. The White House has refused to make results of these surveys public. It says that one-way survey results in 10 European countries—classified secret and is an internal low level staff paper. Sen. William J. Fulbright, chairman of the Senate Foreign Relations Committee, says the survey was prepared for the National Security Council and is therefore, U.S. high level.

Fulbright said the European survey, made late in August, showed that eight of the 10 countries polled thought Soviet Russia would be superior to the U. S. in military power in 1975. Other polls reportedly selected the opinion that Russia already is ahead.

Democratic presidential candidate Sen. John F. Kennedy, accused the Administration of keeping the survey secret to protect Republican candidate Vice President Richard M. Nixon.

Nixon stuck to his position that prestige has never been higher, losing the month or more in London. United Nations when he got strong support from President Ezer Weizman, who said that when "U.S. hear some misguided people say that the U. S. is stumbling into the status of a second-class power and that our prestige has slumped to an all-time low, we are simply listening to delusion of the truth."

The White House said the President spoke from his knowledge of all the facts and just from a position paper prepared for his agency.

Polaris in Scotland

Britain has agreed to let the U. S. station Polaris fleet ballistic missile submarines at Devonport, England, and the British navy has agreed that it can send like to have Polaris submarines in the U. S. but not yet make such an offer.

Britain announced at studying a U. S. plan to give NATO Polaris subs. With Britain and the U. S. now the only free world nuclear powers, but with France making equal, too, as an independent nuclear status, the question of joining NATO with its own nuclear weapons, still is far from settled.

Soviet Premier Nikita Khrushchev's claim that Britain already has nuclear-powered subs armed with missiles is certain to affect thinking on the Polaris station.

U. S. and Britain have ended their 19-year-old agreement on stationing of USM aircraft at British bases. Political demands that Britain have more knowledge of U. S. activities and more control over USM flights from these bases resulted from the shooting down of a British-owned RB-47 over the Russian Sea. Prime Minister Harold Wilson said the new terms mean that U. S. activities from these bases will be "fully known" to his government, but he left unanswered the question of whether Britain now has veto power over specific flights.

Federal Aviation Agency chief F. R. Grenada made a bid last week for the American League baseball franchise in Washington. He will leave AAA in January if he is successful in acquiring the new franchise, created to replace the Senators when they move to Minneapolis.

Aerobot Competition

"Aerobot is not a competitive threat now to U. S. flag carriers, but the Soviet airline will surely U. S. service in four years if it continues to receive the present rate. This is the question Aer Transport Asia. President Stuart G. Tipton closed news from his recent trip to Russia. He feels the pace of Aerobot improvement would be faster if the airline joined the International Air Transport Association.

Tipton feels Aerobot has failed to preserve the public preference for turbojet transports and has made a big mistake in concentrating on heavy jet turboprops.

American Rocket Society and American Astronautical Society are about to restart discussions of a possible merger after a hiatus of more than a year.

Capt. Allen F. Fleming will become the new director of Navy's Astronautics Division in December. Currently commanding the carrier Saratoga, Capt. Fleming will replace Capt. Richard L. Kibbe, who will become Fleet Fleet chief of staff. —Washington Staff

USAF Plans Radical New Space Plane

Studies costing \$20 million sought in next budget; earth-to-orbit vehicle would need no large booster.

By Larry Rodda

Washington—Air Force is requesting \$20 million in its Fiscal 1982 budget for research and development on Space Plane, a radically different manned, winged vehicle that would fly both in the atmosphere—storing oxygen to burn in its engines—and into space as far as the moon.

Space Plane would be a \$60,000,000 follow-on vehicle to orbital versions of the much smaller Dryden-Sear boost glider. The new form would enter orbits designed to lead to flight tests in the 1980-1985 period.

Space Plane would be the first manned space vehicle that could profit itself from earth to orbit and return to earth under its own power, requiring no large rocket booster such as Mercury, Apollo and Dryden-Sear.

Most unusual feature of this vehicle is that it would collect double its fuel weight payload (about eight tons) as it flew through the upper atmosphere, because it would collect oxygen for its engines as it flew.

Dr. Gen. Robert C. Wilson, deputy chief of staff for development, briefly mentioned USAP's concept in a Dryden-Sear follow-on in a recent speech before the Society of Automotive Engineers' Aerospace Meeting and Air Force chief of Scientific Research Assistant, Dr. Seymour S. Low, Bradley (AW Oct. 24, p. 32). Assistant Wright has learned that his reference was to Space Plane and that it is one of four or five other space mission systems for which USAP is seeking development funds.

The vehicle might be used for a variety of missions, including recovery of weapons systems now planned for the replacement by that force.

Several Types of Engines

Members of Space Plane would be accompanied by a team of autonomous engines, possibly of the standard ramjet type, plus jettable rocket boosters. Propulsion in the atmosphere—20,000 to 100,000 ft—would be by means of the ramjet engines, fueled with hydrogen, or with hydrogen-fueled engines. Problems in space would be the result of a conventional rocket system, burning liquid hydrogen and the liquid oxygen of liquid during atmospheric flight.

Reason for the unique outdoor storage system is to enable man to land in facilities from space under a lightweight vehicle at takeoff and checkout points on a test system that are believed to be within the current state of the art and can be available in the true present planned. Space Plane probably would be the last chemically powered space

craft because it is believed that non-chemical propulsion in the medium and nuclear electric fields will be sufficiently developed in the mid-1970's to power a hydrogen craft.

Mothers profile of the vehicle contains the following information:

- Normal atmospheric takeoff, combined with rocket boost to launch both control and forward thrust.
- Rapid climb to upper limits of atmosphere.
- Ability to orbit.
- Orbit for sufficient time to fill tanks with liquid oxygen.
- Proceed on space mission.
- Return to flights of atmosphere for ground collection from users.
- Return to earth for standard approach and landing.

Principle of the fuel system for the space portion of the flight depends on the chemical reactions surrounding burning of hydrogen and hydrogen. Flight portions of oxygen are acquired for every pound of hydrogen. That hydrogen

oxygen combustion produces one of the most efficient rocket propulsion fuels, yielding high specific impulse.

Since the takeoff is gross weight after takeoff would be from 100,000 to 1,000,000 lb., the proportional amount of liquid hydrogen needed to takeoff would be 62,500 lb. However, an unspecified amount of liquid hydrogen would be required for operation with the oxygen extraction system. Estimates for operation run between 10,000 and 25,000 lb. as the extra amount of hydrogen needed for the regenerating and generating cycle.

Air Liquefying Cycle

Design of the vehicle would incorporate a large storage whose open part would be pointed forward. Space principle of the storage would be to gather the very highly associated molecules of oxygen and hydrogen, and through a certain set of processes compress them to a normal gas fluid state. Vehicle speed during this collection cycle would be about Mach 15.

The compressed air would then pass through a heat exchanger to liquefy the liquid hydrogen. Temperature of the exchange would be -252°C or colder, which would liquefy the air. From this exchanger the liquefied air would go to a storage tank. From here it would pass through a flip flop valve to another tank where fractional distillation would take place. Nitrogen with a boiling point of -195°C, would be separated from oxygen, which has a boiling point of -183°C. The nitrogen chamber the liquid oxygen would go to a storage chamber where it would be kept until needed for propulsion.

Although the principle outlined above is not yet possible in accordance with basic rules of physics, major heat transfer problems face the designers because of the difficult task of extracting heat from the gases and liquid hydrogen in flight.

In Space Plane, a large portion of the airplane's takeoff would be taken up with test evaluations, and some engineers believe the vehicle will be essentially a flying rocket with a large space vehicle.

Unless there is a major advance in technology, the vehicle will be constructed of individualism, as Dryden-Sear will be (AW Sept. 26, p. 15).

As first phase of development, the concept will be subject to many changes of the study phase and the research and development phases, but the system is based on studies already completed, such as Northrup's Pacific, a vehicle using an oxygen recovery system similar to the above.



Grumman W2F-1 Makes First Flight

First flight of the prototype Grumman W2F-1 Hercules, a Navy technology study aircraft, was made last week. The aircraft was later demonstrated at a select ceremony at the company's Pomona River facility. The W2F-1 is a two-engine, high-wing aircraft designed for noise detection and control of ultrasonic Navy test flights. For the first time, the aircraft flew at Mach 1.5, supersonic speeds of 1,000 mph, or so, to provide greater speed, efficiency and altitude capabilities than the W2F-1 (AW Jan. 14, p. 31) now performing extensive early testing

missions in the fleet. The Hercules engine system, developed by General Electric's Light Military Electronics Department, is called ALTEC (airborne test engine). This engine/generator/alternator unit may offer other advantages independently or being incorporated in a Next Tactical Data System aboard a Blackjack. Normally the aircraft will enter the fleet in three to four months, making its debut. Carrying a crew of five, the W2F-1 will be one of the Navy's largest engine aircraft. It has a wingspan of 53 ft. and an overall length of 50 ft.

U.S. Supersonic Transport Project With Government Funds Expected

Washington—Development of a supersonic transport through design study contracts let to manufacturers by the Federal Aviation Agency, with National Space and Aeronautics Administration continuing its research and acting as technical monitor of the project, now appears likely.

The principle of government support of the development of a supersonic transport has been strongly endorsed in a series of studies for the FAA by United Research Inc., which found that the airplane industry will not embark on a supersonic project without assistance from the government.

Meanwhile the British Ministry of Aviation has granted a contract to British Aircraft Corp. to begin design studies on a supersonic transport to launch the government by spring that possibilities of competing with the U.S. on the program continue to be explored. Sud Aviation and Avions Dassault have combined to develop a supersonic transport in France (AW May 2, p. 47) and Soviet Russia also is known to be developing such a project.

Under the present plan, study contracts will be let to several manufacturing firms and the best two proposals will be selected to enter the detail design phase of the project. Since FAA does

not wish to equal its present technical staff for the program, technical details will be handled by NASA.

The United Research report found that the market for supersonic transport aircraft is not sufficiently large to support the construction of such an airplane by more than one manufacturer in the free world. It added that as long as no manufacturer can expect to recoup its investment in the program, the financial risks are substantial.

R&D Expense

It noted that the research and development expense alone in completing the program by 1970 will amount to as much as \$1 billion, even with an active R&D program in progress. The report stressed that technical and financial risks will be greater by a wide margin than any previous known commercial risk.

The report found that the airline industry "could and would" be an economic supporter of a supersonic project if it were available in 1970. This conclusion was based on the fact that substantial traffic growth can be expected during the next decade and that the national industry trend toward a steady replacement of older equipment with newer and faster aircraft points

to a requirement for a long haul super sonic transport from commercial use by 1970.

The report concluded that major U.S. carriers will have about \$1 billion in cash on hand by 1970 which, coupled with accruals of some \$400 and less per year from depreciation, should provide adequate funds to support the purchase of supersonic aircraft.

The report estimated that, if the planes could be available in 1970, U.S. carriers would be in the market for 75 in 1970 and 116 by 1975. Cost of each aircraft in the airlines is estimated at \$15 million including spares.

The report warned, however, that although the commercial market for a supersonic transport was large as high as \$1 billion, the market "is not high as \$1 billion." It said they could depend upon manufacturers' ability to produce a plane that can be operated at total costs comparable with those of subsonic jet aircraft. It also said the need to depend upon the capability of the airlines to integrate supersonic operations into existing facilities and procedures without "disrupting economic practices."

The report concluded that there is no reasonable prospect for a purely commercial program for the development of a supersonic aircraft without government support. It stated that the manufacturers are likely to contribute the financial risks involved without some assurance that research and development costs will be recovered.

Crash Kills Nadelin

Moscow—Mikhail Mendelev Nadelin, supreme commander of Soviet Rocket Forces, was killed on Dec. 24 in an air crash, the government news agency Tass said. No details were given.

Soviet Pioneer Nikolai Khabalovs ordered Nadelin to Nadelin's death on Dec. 24, while flying the Lockheed F-104 reconnaissance aircraft last May 1. Marshal Khabalovs has been named to succeed Nadelin as both positions.

Ion Engine Flight Tests Planned for 1963

By Edward H. Kolesar

Washington—Contractible possibility of electric space propulsion programs from industry is being encouraged by the National Aeronautics and Space Administration before it decides next year which four ion engines will be flown in ballistic flight tests of the next year starting in early 1963.

Four tests of ballistically launched, battery-powered ion engines in ballistic flight are planned as a prelude to a 1965 flight of a SNAP 8 satellite system powering both an arc and arc jet engine in a single test.

Hughes Aircraft Co. currently has a development contract for a laboratory arc engine, and General Electric, Avco and Pratt & Whitney have contracts for development of jet engines. NASA wants to extend further study contracts for the field, and it will decide next year which four ion engines will make the first test flights after studying current work, results of an early study contract and industry proposals. SNAP 8 is then to test a 0.1 lb thrust ion engine and a 0.5 lb thrust arc jet engine. The ion engine could be either a single-channel model or a cluster of 10 0.1-lb systems. Primary objective of the first tests,

to be conducted over a 12-month period, will be to assess methods of beam neutralization, to establish the most useful technical design problems in ion propulsion. Secondary objective is to establish engine performance predictions by comparing flight and laboratory data. The ion engine must exhaust a neutral beam, since particles in a charged beam would be attracted to the engine structure and form a cloud at the exit, resulting in an thrust.

NASA feels that a real test of beam neutralization can only be made in space, even though ion engines have been tested for long periods in vacuum tanks. Vacuum chamber walls and residual gases in ground tests are unfavorable influences and therefore do not provide a true environment for studying neutralization methods.

NASA will select one arc electric propulsion system proposal from industry. Industry contract for proposals is the space propulsion program office, headed by Dr. Hans Horowitz. Principal assistants are Dr. R. Schwartz and Dr. Richard L. Hill, assigned to NASA from the Air Force.

Government's aim of expanding industrial interest in electric propulsion was reflected in the establishment last month of a NASA development team

centered in plasma and magnetic development and test of electric propulsion systems, and to consider leading industry projects which show merit. Operating under this committee, which includes Horowitz as chairman, is a technical advisory group. Dr. Ernst Stuhlinger, director of the Research Physics Division at NASA's Marshall Space Flight Center, Horowitz's committee consists of propulsion specialists in NASA's Lewis Research Center and Advanced Research Office, as well as the agency's considerable electric propulsion research, industry research and development, and scheduling of launches will be handled into an orderly program.

NASA's immediate electric propulsion effort is centered around basic research in ion propulsion at Lewis Research Center, basic studies in a space propulsion program at the Marshall Research Center, the four engine development contracts with industry and a number of relatively small contracts to support applied research.

The agency is increasing this effort, mainly through the policy of being prepared to consider, and fund, innovative industry proposals. Horowitz and his staff are compiling a broad-based list of unresolved development problems. Most promising electric propulsion systems for use in the near term are electrothermal, which use the arc heated propellant electrically, or ion beam, and electrothermal, also called magnetohydrodynamic.

As the development contracts are set and for those experimental arc jet engines and ion laboratory ion engine NASA plans to accept proposals for an MHD engine. NASA also plans to fund studies for developing studies to develop space systems, for first generation, ion arc and arc jet engines, specifically where these engines are potentially superior to chemical rockets after stage 2. Studies are expected to result in a neutralization comparison of existing and proposed system stage systems with the 0.1 lb thrust ion, and 0.5 lb thrust arc jet engines.

Ultimate objective for NASA's first generation 0.1 lb thrust ion engine will use the 30 lb SNAP 8 electrical power to develop 1 lb thrust arc jet motor operating between with a specific impulse of 4,000 to 5,000 sec. Hughes Aircraft Co. is contracting an 0.01-lb experimental arc engine under a \$490,000 one-year contract which will expire in September, 1963. NASA will test this engine in laboratory tests before developing whether to have Hughes develop it further in a sophisticated 0.1 lb thrust system, chair 10 0.01-lb engines to

provide this thrust, or to go to other forms entirely for flight hardware. It is expected that at least one flight test will be made of an engine developed at Lewis Research Center.

NASA's ion engine will use the contact method of causing electron flow to produce a particle beam. An Arc or a liquid metal ion-producing method, called ionization (see story, p. 70).

Contact method uses the principle of heating liquid sodium metal until it becomes gas and impinges on the surface of a porous tungsten filament plate, causing negative particles from sodium atoms. Positive ion stream is then focused and brought to desired velocity by a system of electrodes/electrostatic diaphragms.

The stream is neutralized by emitting electrons at low velocity at the exit. The initial design problem is the electron injection is that the negative particles must be prevented from drifting backward into the chamber or a thrust themselves will create from ion current neutral velocity.

While beam neutralization is the space environment is a major problem in ion engine, NASA feels development of this engine also depends on fixing the spacing between focusing and decelerating electrodes, and an alternating optimum particle orbit velocity.

General Electric Flight Propulsion Laboratory and Avco Research and Advanced Development Division, are developing \$240,000 contracts, are developing 0.5-lb thrust arc jet engines in advanced propulsion program. Plasma-dyne Corp. has a \$180,000 contract to build an experimental 0.4-lb arc jet engine to be powered by the Sanderson tube collector-converter system. Post

flight test of a 0.5 lb thrust ion engine will be with the SNAP 8 launch. Flight of a 0.1 lb engine in order must be an arc system. Currently called plasma engine, was a solid gas such as hydrogen or helium in fuel. The gas is heated in a high temperature, passes through an electric arc and is expanded through a nozzle to produce thrust energy. Specific impulse is 750 to 1,500 sec.

Specific research problems in this system are in engine start, pump losses, cooling, propellant storage, heating and heat engine configuration.

Contract to solve these problems are new order development in NASA, which is interested in studies of:

- Engine losses from fuel ionization, arc losses, from heat and electrode degradation.
- Cooling techniques, including active and passive heat transfer.
- Starting methods, using energy, discharge time, arc, movable diaphragms, and conductivity.
- Propellants, including oxygen, ammonia, water and hydrocarbons.

If fuel loss is measured from its stored state, the arc jet engine has the advantage of increasing efficiency from 10 to 60%.

Studies also are planned to determine possible use of beam particles for fuel, since they provide a higher thrust than light ions if they are accelerated at the same velocity. Among potential sources are laser and plasma jets. NASA plans a 35 month feasibility study in the MHD propulsion field including assessment of cost and performance of various systems of plasma propulsion in this fiscal year will go to private industry. Dr. Petering predicted the program would not start yet.

Dr. Albert H. Hirsch, chief, of the division of the space sciences, outlined the scientific objectives of the team and program progress.

He said: "We hope that an active role can be achieved in the Venus orbit for mapping the surface area as far as we can tell, the Venusian cloud cover is opaque to visual systems."

A Mars orbiter will place more on place in the Venusian orbit. The cost portion of the program is to be covered in that planetary mission will depend on results obtained by spaceborne instruments carried aboard the Mars orbiter.

It is clear that a trailing spacecraft for the Mars orbit must be completed. Such a spacecraft would scan visual space of equipment to assist in this biological exploration program. It would provide a long TV reading microscopes working in the ultraviolet and near ultraviolet region, as well as reflectors for calibrating instruments and measuring the changes in the carbon nucleus."

weight capability and mainly for retro-propulsion and landing problems.

• Space probe development for a Saturn-based vehicle capable of placing a sub-orbital or tumbled mobile probe in the surface of the moon or returning samples of lunar material to the earth. Technical staffing, proposals and design competition for Pioneer spacecraft will begin in 1961. Full-scale development will begin in 1963. First launch must meet NASA Saturn launch criteria.

• Service. This project, also in the study phase, is aimed at a controlled soft landing on the moon. Service will use a Centaur launching vehicle. Its payload will range in mass, including guidance, communications, and it should be able to soft land about 100 lb of instruments on the moon. Five companies now have NASA contracts for design studies on Service. They are Hughes Aircraft, McDonnell Aircraft, North American Aviation, and Space Technology Laboratories.

• Ranges. In this program for flights of a JPL-developed spacecraft with Atlas-3, the first flight will be used in rough land (100-300 mi), impact, instrument packages weighing up to 70 lb, on the moon. Progress up to the point of injection in the responsibility of the NASA Marshall Space Flight Center.

Private Industry

Dr. Petering held 600 industrialists attending the meeting, which closed 45% of the 100,000 attendees. JPL will open for NASA on its fiscal year and plan program in this fiscal year will go to private industry. Dr. Petering predicted the program would not start yet.

Dr. Albert H. Hirsch, chief, of the division of the space sciences, outlined the scientific objectives of the team and program progress.

He said: "We hope that an active role can be achieved in the Venus orbit for mapping the surface area as far as we can tell, the Venusian cloud cover is opaque to visual systems."

A Mars orbiter will place more on place in the Venusian orbit. The cost portion of the program is to be covered in that planetary mission will depend on results obtained by spaceborne instruments carried aboard the Mars orbiter.

It is clear that a trailing spacecraft for the Mars orbit must be completed. Such a spacecraft would scan visual space of equipment to assist in this biological exploration program. It would provide a long TV reading microscopes working in the ultraviolet and near ultraviolet region, as well as reflectors for calibrating instruments and measuring the changes in the carbon nucleus."

Swiss Favor Mirage III, Saab Draken

Bern-Luxemburg F3040 and Dassault Mirage III, the two remaining U.S. entrants in the wing Swiss (see competition for a new fighter model), was tentatively asked out last week apparently leaving the field open to France's Dassault Mirage III and Sweden's Saab J35 Draken.

Cost was given as the primary reason behind the decision to eliminate the F 304 and F35JF II from consideration, but Swiss Aviation, looking at the bottom part of the competition which is now some two years old, expected some hope that one or both might again be reactivated.

Swiss military officials apparently favor the Mirage III (in the spirit that you must immediately operate from the air base's short runway, land quickly, fly fast, and carry out the standard combat mission required over a wide support fighter leaders and interceptors).

An issue which has been discussed by the Mirage's leading characteristics and high altitude performance, and Swiss officials are waiting upon an advanced air warfare for control system, which Dassault says it can accommodate by extending the aircraft's length.

Mirage III proposals, however, already have been deleted on at least two occasions in the past by the Swiss political administration which holds at the thought of any large order from a country belonging to the European free movement zone, namely, in France, that when a similar product can be purchased from the rival Great Britain of which Switzerland is a member. Since Sweden has a similar deal of the Great Britain, this factor could serve to give the Draken one of its biggest hopes.

Deadline for a final decision is being delayed to the past of the vote at last and, as an effort to increase political confidence, the Swiss may invite the Mirage III and Draken, to demonstrate their capabilities in operating from the air base's cramped mountainous fields.

In planning any new order, the Swiss have to allow future flights that would permit Switzerland's own industry to build some of the aircraft involved including engines.

The Swiss Air force at present is composed of 500 helicopter combat aircraft, 100 B-100 fighters, 150 B-100 fighters and 150 B-100 fighters.

NASA's Voyager Venus Probe To Make First Flight in 1965

Pasadena, Calif.—National Aeronautics and Space Administration's Voyager probe vehicle will use Saturn C-1 and booster, and research and development flights to Venus in 1965. Dr. William F. Pickering and staff members from Caltech Institute of Technology, Jet Propulsion Laboratory, and in a contract with industry, officials here last week.

The Saturn C-1 will give Voyager enough additional flexibility to permit flight outside of the plane of the earth's orbit in 1965 and before, as well as to Venus in 1965.

Four other NASA space projects are being developed as well:

- **Marscope.** It will provide Voyager and be a basis for its development. Generalized Mission will conduct its first

mission, a Venus fly-by, in 1962. The second Mars mission scheduled is a deep space probe launched in 1963 with a booster, and research and development flights to Venus in 1965. Dr. William F. Pickering and staff members from Caltech Institute of Technology, Jet Propulsion Laboratory, and in a contract with industry, officials here last week.

1

deploring the Pennsylvania Railroad in the tie to the airline and that measure approved in 1950 and 1960.

Baker began explorations of merger possibilities in December, 1955, when, at a board of Directors meeting, a special committee was established for the purpose of studying the possibility of merger. The committee consisted of five board members, including Baker.

During the ensuing period, formal economic studies of merger possibilities, eight airlines or combinations of airlines were made, and direct approaches with other carriers began. In all, informal discussions of possible mergers were held with TWA, Eastern, Eastern, Delta, Northeast, and Northwest. United was the last carrier to be contacted.

An part of his effort to contact the difficulties in Capital's operations, Baker developed a financial program designed to provide liquidity, financing and more rigorous control to the airline and the Vietnam debt from 1961 to 1970 at an average interest rate of 4 1/2 percent of 4 1/2.

A meeting was held with Vietnam in February, May, 1970, to discuss the feasibility of launching the new financing program at the same time the merger studies were being conducted. Baker it was apparent that the proposed program by within the realm of possibility. Capital got first priority on the proposed merger proposal, and eventually the merger was placed second in order of importance.

The overall plan called for reduction of size DCA-35 and Delta L-1011 in 1970, with full retirement of three remaining L-1011s by July 1980. A full fleet of 11 DCA-35s, which were leased in 1970 for 18 months at \$12,500 each per month, was dated to replace the old aircraft. Balance of DCA-35s were to be retired when small 4400s were replaced from Capital's current fleet by the CAB. Purchase of Boeing 747-200 freighter aircraft was also being considered. The plan was included in the program.

To increase capacity seats in the Vietnam was increased from 44 to 46 by eliminating one location, and further plans were made to increase the number to 50-55. The plan was to replace Vietnam by the fleet from a wide-body capacity standpoint, according to Baker.

Meanwhile, Baker established a department to coordinate route matters, which were made into recommendations to San Antonio, Houston, Dallas and Toronto and a firm plan was developed to obtain authority to withdraw from 11 small stations. The carrier was provided a Coast-to-coast schedule in 1975 and a Mississippi-Chicago route in 1979.

Six new management members were brought into the company by Baker in

a management move. An organization manual was published and an executive management committee of the top six officers was created to consider major policies and decisions. All current budgeting agencies were controlled by a holding committee, created with six officers and five representatives of department and marketing and planning departments were established.

A management analysis was then formed to evaluate company performance and the development of its regional and plan the all management functions and facilities were provided for by retaining Wallace and Clark Consultants.

Baker made several moves to reduce costs, including an increase in Vietnam obligations from \$11 by 1970 to \$201 by 1979. According to Baker, Capital's key factor in 1970 was second highest of all regional carriers compared with Delta place in 1977, and its load factor of 55.4% in 1970 compared with a regional average of 55.7%. He added that, despite this performance, Capital's revenues increased from \$94.1 million in 1970 to \$109.5 million in 1979. He pointed out the reason for the relatively high load factor was the airline's ability to add seat miles in carefully planned increments in new competitors, had been the basic reason why overall revenues did not go up as rapidly as other carriers over that period.

"Capital's ability to add seat miles in carefully planned increments in new competitors, had been the basic reason why overall revenues did not go up as rapidly as other carriers over that period, such as load factor, showed outstanding results."

Baker's move to help a steadily rising equity level included a 1970 commitment to use DCA-35 and Delta L-1011 in 1970, with full retirement of three remaining L-1011s by July 1980. A full fleet of 11 DCA-35s, which were leased in 1970 for 18 months at \$12,500 each per month, was dated to replace the old aircraft. Balance of DCA-35s were to be retired when small 4400s were replaced from Capital's current fleet by the CAB. Purchase of Boeing 747-200 freighter aircraft was also being considered. The plan was included in the program.

To increase capacity seats in the Vietnam was increased from 44 to 46 by eliminating one location, and further plans were made to increase the number to 50-55. The plan was to replace Vietnam by the fleet from a wide-body capacity standpoint, according to Baker.

Meanwhile, Baker established a department to coordinate route matters, which were made into recommendations to San Antonio, Houston, Dallas and Toronto and a firm plan was developed to obtain authority to withdraw from 11 small stations. The carrier was provided a Coast-to-coast schedule in 1975 and a Mississippi-Chicago route in 1979.

With Vietnam to delay the long-term plan pending the merger agreement, Baker's move to help a steadily rising equity level included a 1970 commitment to use DCA-35 and Delta L-1011 in 1970, with full retirement of three remaining L-1011s by July 1980. A full fleet of 11 DCA-35s, which were leased in 1970 for 18 months at \$12,500 each per month, was dated to replace the old aircraft. Balance of DCA-35s were to be retired when small 4400s were replaced from Capital's current fleet by the CAB. Purchase of Boeing 747-200 freighter aircraft was also being considered. The plan was included in the program.

He suggested that a continued operation of the Vietnam fleet, combined with a settlement of equipment matters, would be the best way of settling out of the airline's debt. At the same time, he proposed that partial payment toward principal could be made by the airline in the form of a coupon and bond. Baker's move to help a steadily rising equity level included a 1970 commitment to use DCA-35 and Delta L-1011 in 1970, with full retirement of three remaining L-1011s by July 1980. A full fleet of 11 DCA-35s, which were leased in 1970 for 18 months at \$12,500 each per month, was dated to replace the old aircraft. Balance of DCA-35s were to be retired when small 4400s were replaced from Capital's current fleet by the CAB. Purchase of Boeing 747-200 freighter aircraft was also being considered. The plan was included in the program.

With Vietnam to delay the long-term plan pending the merger agreement, Baker's move to help a steadily rising equity level included a 1970 commitment to use DCA-35 and Delta L-1011 in 1970, with full retirement of three remaining L-1011s by July 1980. A full fleet of 11 DCA-35s, which were leased in 1970 for 18 months at \$12,500 each per month, was dated to replace the old aircraft. Balance of DCA-35s were to be retired when small 4400s were replaced from Capital's current fleet by the CAB. Purchase of Boeing 747-200 freighter aircraft was also being considered. The plan was included in the program.

Supplemental Airlines Win Court Approval

Washington—Supplemental Airlines won a major legal victory last week when the Supreme Court overruled an appeals court decision which challenged the authority of the Civil Aeronautics Board to authorize them.

Overturning the U.S. Court of Appeals for the District of Columbia Circuit decision in the *Large Freighters* case, the Supreme Court earlier ordered the appeals court to retain jurisdiction over the case until further judicial review was completed. The decision was signed by President Carter's last job in the White House's administration for a 20 month period.

In another action, Delta Air Lines was denied review of a court of appeals decision which ordered the airline to pay back more than \$1,795,000 as already incurred paid Chicago and Southern Airways, which was absorbed by Delta in 1951

State Regulation Threat Worries Airlines

By Robert H. Cook

Washington—Carriage legal battles between Bonanza and Frontier Airlines and the states of Nevada and Nebraska are being fought with concern by many airlines, which fear that radical support of these states' regulatory moves could encourage other states to enforce a complex of restrictive airline regulations which have long hampered interstate commerce.

Reacting against the use of state's rights versus federal regulation, the two cases are regarded as a direct challenge to the Civil Aeronautics Board's power in permitting local service and local airlines to operate in interstate service over the objections of state economic or public utility commissions.

While the case in Nevada and Nebraska are considered only as preliminary steps to the state's authority to regulate interstate air service, the two cases are regarded as a direct challenge to the Civil Aeronautics Board's power in permitting local service and local airlines to operate in interstate service over the objections of state economic or public utility commissions.

CAB Hurd's Intervenor

So far, the CAB has not intervened in these court cases, but the Board could later be forced to do so if the state courts uphold Nevada and Nebraska, which would force the two local service carriers to take positive action to start new routes in the state which were previously denied to them by the CAB.

Caught between state and federal courts, Bonanza and Frontier are faced with heavy fines and penalties from the state if they do not start new routes in the state which were previously denied to them by the CAB.

Reacting to the fact that CAB has been attempting to curb its strong industry self-help movement in the "use it or lose it" formula under which its local service carriers are permitted to drop the proposed service, CAB says it may be forced to finally establish its authority over these and other similar cases through a series of court judgments.

While these problems are being faced in only a few states now, that number will be expanded considerably, since 37 states have constitutional or statutory control over zoning powers of air transport within their borders. Although a majority of these states have not attempted to apply these laws, 22 have some form of control over airline routes, 16 can require local airlines and airlines to obtain approval for any interstate operations and 18 have regulations requiring the filing and approval of all tariffs before

their implementation within the state.

Although the possibility was seen some of this time, there is also a danger that the state legal situation might lead to a revival of interest in individual regulation of interstate air service, which has been a topic of debate for many years. Such legislation was introduced 17 years ago in 21 state legislatures, but it was not until 1961 that the states of Nevada and Vermont in a divided form.

What Bill Requires

Prepared by the National Airline and Utility Commission, the bill would require interstate carriers to obtain certificates from the state for interstate operations, would subject the carrier's interstate rates to local controls and its interstate routes to state controls. The bill would also require the carrier to start new routes in the state which were previously denied to them by the CAB.

With the Bonanza and Frontier cases, plus growing problems in California, Illinois and elsewhere, airlines already are facing a potential liability for major disruptions which the NACU legislation would have caused.

Carriers were not to take positive action to start new routes in the state which were previously denied to them by the CAB. The bill would require the carrier to start new routes in the state which were previously denied to them by the CAB. The bill would require the carrier to start new routes in the state which were previously denied to them by the CAB.

Immediate Threat

In the more immediate future, many airline observers view the use of state powers as a possible threat to CAB's authority to regulate interstate air service. The bill would require the carrier to start new routes in the state which were previously denied to them by the CAB. The bill would require the carrier to start new routes in the state which were previously denied to them by the CAB.

In the case of Bonanza, the airline was criticized by the State of Nevada as an interstate carrier in 1946 over a Reno-Las Vegas route which later involved the issue of Hamilton and Tonopah. Several court cases, the airline was granted a certificate for interstate operations by the CAB and last year started the Public Service Commission of Nevada that it intended to drop

service to Henderson and Tonopah as the basis of CAB approval, which the airline maintained had precedence over state authority.

The Nevada Commission ordered the airline to start service to Henderson and Tonopah as the basis of CAB approval, which the airline maintained had precedence over state authority. The Nevada Commission ordered the airline to start service to Henderson and Tonopah as the basis of CAB approval, which the airline maintained had precedence over state authority. The Nevada Commission ordered the airline to start service to Henderson and Tonopah as the basis of CAB approval, which the airline maintained had precedence over state authority.

The case was filed in Nevada's Third Judicial District Court, and was heard in September as a different set of facts were the airline's argument was based upon a CAB decision order. A subsequent Board order, issued last July, denied the two cases from the airline's routes. No decision was reached by the start last week.

Frontier Case

While Bonanza's case has involved only two points, within the state of Nevada, the Frontier Airlines case involves two state court decisions in Nebraska. On the basis that in August 1971, serving the state of Chadron, Nebraska, and elsewhere, Frontier was producing only 1.5 million miles of air service in the state of more than \$140,000, Frontier was authorized by the CAB Aug. 9 to suspend that service.

Two days later, the Nebraska Railway Commission issued a new regulation requiring its approval before any new drop or added air service to other state points. On the strength of this regulation the commission also obtained a temporary injunction from a state court to prevent the airline from withdrawing the service. In the meantime, serving the segment. At the same time, the Nebraska Aeronautics Commission, ordered as the court case by the CAB, filed for review of the Board suspension order by the Court of Appeals in St. Louis.

Last week, Frontier moved to block operation of this state action by asking the U.S. District Court in Lincoln for an injunction to bar the state laws preventing the reduction of Frontier's service to Sidney, Imperial, McCook and Kearney on Segment B1.

On the question of whether CAB would enforce its orders to drop



POWER TO FLY...POWER TO PROTECT... by Pratt & Whitney Aircraft. Today the Strategic Air Command's Basing B-52 bomber has a new profile. Inboard from its J-87 turbojets, two more Pratt & Whitney Aircraft jet engines have been added—a pair of J-88s. These engines power the North American Howard Dog guided missile, designed to deliver a nuclear warhead behind enemy lines at supersonic speed. And for faster take off, the power of the twin Howard Dogs augments the thrust of the B-52's eight J-65s. Aft, both the bomber and the Howard Dogs can be refueled from aerial tankers. The application of the J-88 jet engine to the Howard Dog missile is another example of Pratt & Whitney Aircraft's expanded activities in new fields of power.



Pratt & Whitney Aircraft East Hartford, Connecticut/A Division of United Aircraft Corporation

BAC Bins Production Hopes on VC.10

Widely, England-British Aircraft Corp. is pinning its chief hopes for continued aircraft production through 1965 on a family of five second generation jet transports based on the stretched and VC.10 design, now being built for British Overseas Airways Corp.

First of the new transports is scheduled to be first year end to start coming off the production line in 1965. Sir George Edwards, executive director of BAC, told Aviation Week that production is scheduled to coincide with the anticipated next round of major equipment purchases by airlines.

This is the way BAC is planning production of the VC.10 series at the Victoria-Armstrong plant here.

• Mockup of stretched VC.10 has been completed and fuselage and wing sections are now on the assembly line. British Overseas Airways Corp. has ordered 35 of this model. A long range aircraft capable of operating over stage lengths of 2,000 miles on four engines is short at 7,000 ft., the VC.10 is designed for 30,000 ft. For East routes where airports are not too distant or at high altitudes, or are limited in runway length. It will carry a 55,000 lb payload, for example, on the 4,600 mi. Singapore-Singapore route where flights from 3,000 ft. runways are required. Aircraft will be powered by four Rolls-Royce Conway RC442/2 bypass engines of 12,250 lb thrust each, now in the development stage. Engines will be manufactured in the fuselage.

• Super VC.10 is a stretched version of the VC.10 and is designed for gateway-to-gateway operations over high density routes such as the North Atlantic via MONT, which has been ordered 10 of the aircraft. Fuselage has been extended 20 ft.—28 ft. of it forward of the wing. Capacity is scaled to 212 economy class passengers (AW Aug. 29, p. 47). Powerplants will be the Rolls-Royce RC444/2s. Maximum payload will be 55,000 lb., maximum gross weight 147,000 lb and maximum fuel capacity will be 141,000 lb. Super VC.10 will be 800 ft. long.

• BAC now plans to make a bid for the U. S. market with a still larger model of the VC.10 which engineers here call the "super super VC.10." Sir George Edwards said the airplane is still on paper but is being designed to operate over ranges of 6,700 mi. so it can serve airport schedules between mid-continent points in the U. S. and mid-continent points in Europe. Fuselage will be increased 9 ft. in length. It will carry 232 passengers and will have a payload of 55,000 lb and a maximum takeoff

weight of 165,000 lb. The airplane will be powered by four Rolls-Royce Conway Stage 7 bypass engines rated at 24,000 lb. and fuel some thrust also in the development stage. Fuel capacity will be 24,000 gal. with the addition of wing tip tanks. For American World Airways is reportedly showing considerable interest in the airplane.

• Chances are now strong that BAC will launch its VC.11 transport, a scaled-down version of the VC.10 designed for intercity, medium-range routes. Trans-Canada Air Lines and at least one U. S. carrier have indicated an interest in ordering the aircraft if it goes into production. Although these orders would not be sufficient to provide a local market for the manufacturer, they may be considered adequate to launch the VC.11. The VC.11 will be powered by four Rolls-Royce RB.165 bypass engines of 11,000 lb thrust each. It will have a maximum payload of 25,150 lb and a maximum range of 1,700 miles. It will be able to carry from 140 to 150 passengers, depending on configuration. Design will be exactly the same as the VC.10 model.

• Fifth model of the VC.10 family is the proposed all cargo, cargoless version of other designs in super VC.10. Project design work on the airplane has been completed. Both aircraft will be powered by Rolls-Royce 42/3 Conway bypass engines developed in 1955 to replace the four BAC VC.10 freighter will have a maximum design payload of 95,000 lb, which can be carried over a range of 2,150 miles with a two-hour fuel reserve. Using Air Transport Area, out methods, the VC.11 and super VC.10 freighter will have maximum operating costs of 45 and 47 cents per ton mile respectively. Now it opened and closed by a hydraulic jack, exactly controlled into the right deck. Now it swings on two hinges mounted on the starboard side of the plane, the lower hinge carrying the thrust load and the top hinge the cabin load.

Production Plans

Supplementing the VC.10 series in production plans during the next five years is the BAC 107—a two-engine jet transport designed as a replacement for the Viscount and the Concord 440 (AW Oct. 13, p. 45). Sir George said that sales potential of the aircraft is so low operating costs because of the

relatively low expense of two powerplants versus three or four engines. The BAC 107 will be powered by two all-weather Bristol Siddeley BS313 turbojet engines.

Sir George said the potential over additional sales of the Vickers Vanguard turboprop transport, which is slated for delivery to Trans-Canada Air Lines in December. He said the airplane was designed to permit operations at low density, but because delivery of the Vanguard was delayed beyond the summer months of 1960 as a result of turbine trouble in the Rolls-Royce Tyne turboprop engine, the airplane has not had a chance to prove itself in scheduled operations at low fares (AW Oct. 10, p. 52). The Vanguard currently is in production at the Victoria-Armstrong plant here.

Victory, now owned by BAC group, is also still producing the Vickers Viscount 510. Sir George said that he expected an "unpredictable drizzle" in sales of the aircraft in the foreseeable future and projected that operations would be discontinued as a result of Vickers in the next several months as new re-equipment programs are launched.

Load Claimed for VC.10

Sir George feels that the VC.10 series, when available for delivery, will be more advanced in design and performance characteristics than any other long-range transport available in 1965. The VC.10 is a stretched version of the BAC 107, which has been developed from the BAC 107 by moving second generation aircraft into production now. He added that during the next five years, passenger workloads will be made on the basis of what in 1965, the VC.10 may be a complete new airplane compared with its present design.

A strong advocate of the maximum engine principle, Sir George claims that there are many advantages. Improvements in the design in addition to such aerodynamic benefits in creating better high Mach characteristics as a result of a clean wing and slowing use of full span leading edge high-lift devices at wakeful trailing edge for high lift at comparatively slow speeds.

He referred to such "byproducts" as reduced engine noise, no ground-to-air clearance problems, better climbing characteristics and better wide variety of payload usage permitting close load planning. Sir George said that the combination with three-engine aircraft on grounds that such a design is too costly for airworthiness reasons in scheduled operations and a lack of sufficient payload for long-range operations.



FACILITIES expansion at Tulsa Municipal Airport includes (1) new tower (2) new lounge (3) Aeroline Airlines control base (4) high speed jet taxiway (5) Douglas Aircraft plant and (6) extension landing system runway. West side of field will be devoted to business aircraft.

Tulsa Spending \$10 Million on Airport

By Karen J. Bellon

Tulsa, Okla.—Progress program totaling nearly \$10 million is under way to modernize terminal and operating facilities at Tulsa Municipal Airport. When completed and in operation in January, 1967, the new configuration will increase terminal air security and more than double current gates in addition to improving present runway by adding a taxiway designed for up thrust air transport operations.

In addition to providing increased facilities for airline tenants at the field, the modernization program is expected to be a boon to business plane operators at the airport by giving them additional space.

Construction this for a new 165-foot tower, completion, in terms of money spent. Steel structure has been erected for the new tower building, including a hoisting and baggage claim wing and erection of steel for the east concourse will begin immediately, with that for the west concourse going up Oct. 20. Structure to house a new airport surveillance radar is 95% complete and this equipment is expected to begin operating in January.

New terminal building will provide

some 150,217 sq ft of space, and a new 10,000-sq-ft baggage air cargo building will be erected adjacent to this structure. The present terminal building, built in 1941 with the first addition made in 1954, contains some 55,000 sq ft.

It has seven gate positions, the new building will provide 16. The terminal is being designed so that passengers will have a walk of less than 1,000 ft from the center of the structure to the field, jet gate position. Concorde aircraft will be able to handle baggage of those airlines simultaneously. Adjacent to the new terminal will be an 80-ft parking lot, which will be capable of expansion to 1,000 autos.

Some 1,200 ft from the terminal, a 50-acre parking will be erected by Airport Parking of American, Inc., with work to start on this facility in 90 days. A new control tower, approximately 157-ft tall, will also be erected at the non-traffic side of the field.

When the new terminal building and control tower are operating, the original terminal building will be made available to business aircraft operators and the airport plans to lease space in the old tower to Federal Aviation Agency for use as maintenance offices.

The new terminal, however, will provide a gate for business aircraft users, as it does now at the present building, to facilitate transfer of executives who wish to connect at the airport with scheduled airlines. But with the new building operating, business aircraft operations—some as many as 200 business aircraft based at the field—will have the outer east side of the airport for this use.

New towers, to parallel the main runway, which has instrument landing system and automatic lighting approach and landing lights, is designed with high speed taxiway for jet aircraft. Tulsa Municipal Airport is now under joint operating at the field next year. The airport already is the home of considerable jet activity, since American Airlines has its main terminal base on one side of the airport and Douglas Aircraft Co. maintains a Boeing B-77 overhaul base on another side.

Considerable expansion in passenger operations is forecast for the field. Last year nearly 425,000 passengers, nearly evenly divided between arrivals and departures, were handled through the field, compared with more 358,000 the prior year. An FAA forecast indicates that by 1965 Tulsa Municipal will be



ARTIST'S conception shows design of new Tulsa airport terminal, new inside construction. Layout provides for 16 gate positions.

handling more 548,000 passengers annually.

City financing of the municipal portion of the expansion has been approved by the voters in a 4-1 margin. Federal Aviation Agency has approved an allocation of \$5.5 million. Tulsa Municipal paid well in its planning, says it got the project under way in time to take advantage of then-existing federal financing of terminal facilities, which no longer is possible.

The airport is considered a model facility in terms of financing. It has almost completed the first phase of \$440,000 on a gross of \$1,287,000, which was an estimate of some 18% over the previous year despite the fact that revenue from fuel sales dropped considerably due to a market decline in industry transport operations. But, because the drop was an increase in fuel sales to business aircraft.

Tulsa Municipal operates under the non-revenue Tulsa Airport Authority, consisting of four non-political representatives, plus the mayor and all its revenues are set aside in a separate category and are not available for other uses, airport manager Pat Coombs said. The airport has always paid all of its own operating expenses, employs all staff and capital expenditures and does not look for help, but continued to place it back into airport improvement, leading fees are not charged terminal users.

It retains the fuel concession, the airport's biggest source of revenue, rather than let it be to one of the operators and then collect fees. Airlines, however, do

handle their own fueling operations.

The authority has strong backing because the city is fiscally sound. Indenture of this is shown in its attachment to the business plan. In 1955 the Authority established a separate airport facility. Revenue Airport, to overcome the growing lack of private funds

due to rail corridor development. Revenue Airport, which now has some 88 business and private aircraft based there, has operated in the black for a net of about \$1,000 per month since the second month of its start. The city has an investment of approximately \$1.5 million in this field.

Ethiopians Plan Trans-African Link

Conaco, Franco-Ethiopian Airlines is making plans to inaugurate a trans-African air service which will directly link for the first time East and West Africa.

Ethiopian Airlines officials, meeting at Geneva and the first flight has been set for Nov. 5. Flight will book up Addis Ababa, the Ethiopian capital, with West African points in Nigeria, Ghana and Liberia. Thus, for the first time, travelers will be able to cross Africa directly. Previously, an airline on Africa's West Coast took African East Coast points via Western Europe. Africa, which for years has been largely operated by three West African airlines under a management contract with the Ethiopian government, plans to use Douglas DC-6s.

Flight would leave Addis Ababa on Tuesdays for Khartoum, Sudan. Next leg—some 2,000 mi.—to Lagos, Nigeria. At Lagos, Nigeria, on the West African coast. At the moment, bilateral discussions are still going on between Ethiopia and Nigerian governments over passenger rights. It is expected an agreement will be reached by Nov. 8. If not, then Lagos will be used as a refueling stop.

After Lagos, next regular planned stop will be Accra, capital of Ghana. Flight will terminate at Roberts Field, near Monrovia, capital of Liberia.

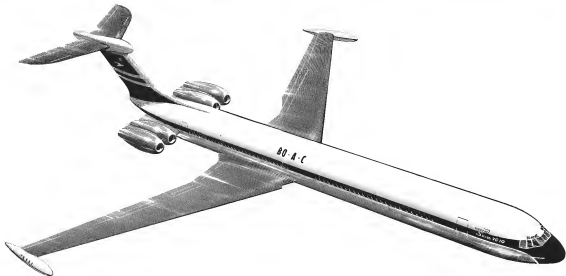
Ethiopian government is interested in the new route for political reasons, as well as commercial. With its share and more of the East and West African nations becoming independent, there is a natural desire for Ethiopia, one of Africa's oldest national states, to communicate with its new neighbors. Addis Ababa government, for example, used its national airline to play an important transportation role in the Congo affair.

In addition to such political motives, Ethiopians believe efforts are in motion to provide routes which they consider has great traffic potential. There is a good deal of traffic, for example, between the Middle East and West Africa. With its new route, Ethiopian Airlines expects to provide this market with the most direct air route between the Middle East and West Africa.

Moreover, Addis Ababa is becoming the center for United Nations' technical aid to the state of Africa. This angle attracts is expected to generate considerable trans-African traffic over the next few years.

BOAC ORDERS 10 VICKERS SUPER VC 10's

FROM BRITISH AIRCRAFT CORPORATION!



BOAC has followed its contract for 35 Vickers VC 10 jetliners by ordering from British Aircraft Corporation ten Super VC 10's—aircraft which are tailor made for high density routes such as the North Atlantic.

In an economy class layout the Super VC 10 can carry up to 212 passengers plus 4 tons of freight non-stop from London to New York against strong headwinds.

Both Vickers VC 10 and Super VC 10 with their new look clean wings and rear mounted engines will offer an air field performance and a cabin comfort which will make them the most passenger preferred long haul jets in operation.



AIRLINE OBSERVER

► American Airlines officials are discussing the Canadair Mark VII transport, powered by General Electric CRJ60-23 jet engines (AW Aug. 8, p. 51), with Sud Aviation in France. Fleet of 40 is under consideration. Canadair is currently specifically unsuited as a two-engine transport for its medium-range jet requirement. The Canadair 60 is a wing-mounted (AW Aug. 1, p. 49).

► Although Russia officially denied granting its IJLs (Intercontinental Jet Liners) to U.S. observers in Russia, gave ample evidence that the aircraft had gone into trouble. Until about Sept. 1, IJLs were specifically mentioned whenever they carried important persons into or out of Moscow. A complete blackout on IJLs followed then began and continued until mid-October. At that time, Soviet newspapers broke the silence by reporting that Illegals (Foreign) Jumbo Kinds flew from Moscow in an IJL and that another special IJL flight carried Russian doctors and engineers to Kabul, Afghanistan, to conduct a cholera outbreak—whatever the transport was back in service (AW Oct. 24, p. 39).

► Negotiations between the U.S. and India on intercontinental jet transport pact have been looking off because of India's refusal to accede to U.S. demands that capacity and flight frequencies be increased without regard to U.S. flag carriers be lifted. U.S. sought an increase in the number of flights from India from 10 to 16 weekly, but the Indians held that there could not be any other policy of traffic control because agreements with other countries contain similar provisions. Meanwhile, rumors are strong that India will be granted permission to add Moscow as an alternate stop on Air India's U.S. India route.

► Federal Aviation Agency has asked Britain, Canada, Ireland and Portugal to participate in a project designed to determine air traffic control capacity requirements on the North Atlantic for the 1985-70 period.

► Flight Engineers International, Inc. President Ray Brown has charged that flight crew, unacceptably caused by unfair introduction of jet equipment is running ahead of expectations. He said the number of men this season expected to lose through layoff during the entire period of transition in jet aircraft have lost their jobs at the halfway point of the jet-challenge.

► Supreme transport council will lead the list of items scheduled on the agenda of International Air Transport Association, Technical Committee slated to begin Aug. 17 in Montreal.

► British Airways will reduce its lowest fares on U.S.-Latin American routes 35% effective Aug. 1 in accordance with agreement reached in the London Area Air Transport Association traffic conference at Geneva (AW Oct. 14, p. 41). First class fares will be reduced up to 40%. Fares are subject to government approval.

► Czech Airlines has received stockholder approval to increase authorized common stock from 2 million to 4 million shares and to convert these outstanding shares of stock into one new class of common. New certificates for Class A and B stock and general consensus stock will be issued as a one-for-one basis.

► Alouette Airlines is now operating four of the five Canadair 510 helicopter transports it has in order. The carrier reported to the Civil Aeronautics Board that the fleet will allow, total direct operating costs of \$5.36 cents per enroute mile or 1.5 cents per available seat mile on regular service. Noisy Engines, Inc. is now manufacturing a spare engine pool and parts supply in Washington for the Elan engine which powers the Canadair 510. Plans are for an expansion of parts and overhaul facilities in other U.S. areas.

► United Air Lines is debating between a convertible preferred stock or a convertible bond issue to finance its order for the Boeing 727, assuming Boeing decides to build the aircraft. Some form of equity financing appears to be necessary as a market looking more too solid.

SHORTLINES

► British Overseas Airways Corp. reports it carried 626,000 passengers on its world-wide routes during the first year ending Mar. 31, 1960, an increase of 20% over the previous fiscal year. Load factor—passenger and cargo—rose 29% to 360 million. BOAC aircraft flew 176,824 hr and 13.6 million mi. The carrier has announced it will begin transatlantic change route next month to connect Douglas DC-7C aircraft with a period capacity of 12,000 lb. Two of BOAC's DC-7Cs are now being converted at the Douglas Aircraft Co. Santa Monica plant to DC-7F cargo configuration.

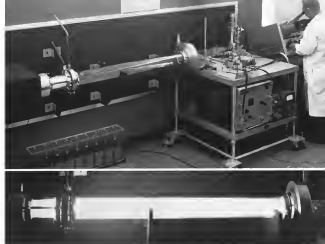
► Delta Air Lines was scheduled to begin daily Conquest 550 line service Oct. 30 from Philadelphia International Airport, which serves Washington and Baltimore, to New Orleans and Houston. The new service will operate and terminate in Philadelphia.

► Eastern Air Lines' new Douglas DC-8 service between Boston and Miami was scheduled to begin Oct. 12. Service will begin with a daily fast day flight to Philadelphia and four nonstop night coach flights a week.

► Federal Aviation Agency will begin using a new type of criteria questionnaire for all applicants for Airline Transport Ratings in November. The new questionnaire consists of problems normally encountered in flight planning, interpretation of weather data, navigation, use of radio aids and explanation of Civil Air Regulations. Applicants who have successfully completed one or more parts of the old sectional examination will be permitted to take the written which they find agree if they apply before July 1, 1961.

► Sabena Belgium World Airlines has started modifying its Pratt & Whitney J44A turbojet engines in accordance with contract 17820 to order the Sabena fleet of Boeing 707 turbo-propellers to take off with increased payloads at airports where runway are not long enough to permit takeoff with a full load.

► Trans-Canada Air Lines has signed a negotiated agreement with the Ilan group state airline, Malat, under which both carriers will book passengers on the other carrier when passenger capacity in their country (Hungary is the fourth East European nation to reach agreement with TCA—the other three are Poland, Czechoslovakia and Yugoslavia).



PLASMA AND PROPAGATION Electromagnetic attenuation as a function of frequency, and magnetic window techniques to alleviate the propagation problems, have been predicted and verified with the Bendix electrically-excited shock tube. These are the keys to future communication with hypervelocity vehicles. Career positions are open in both theoretical and experimental plasma physics, and communications.

BENDIX SYSTEMS DIVISION

ANN ARBOR, MICHIGAN



NOW...LIQUID HYDROGEN

from the first privately owned plant

With a capacity of 13,000 lbs./day, the new LINDE liquid hydrogen plant at Torrance, Calif., is prepared to meet current requirements. This expensive liquid fact is available in lots or in larger quantities, for operations or research.

The new LINDE plant is the first privately-owned large liquid hydrogen plant in existence. Designed, constructed, and operated by LINDE engineers, financed by LINDE capital, and implemented by LINDE delivery and storage facilities, it marks a long step forward in liquid hydrogen supply.

The product delivered from this new plant contains less than two parts per million in impurities. It is suitable for all purposes including fuel, laboratory experimentation, or engine testing. Distribution in tank trucks and containers insulated with LIQHT super-insulation keeps losses remarkably low.

For additional information on this new LINDE facility and its products, write Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. In Canada, Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

LINDE COMPANY UNION CARBIDE

"Linde" and "Union Carbide" are registered trade marks of Union Carbide Corporation.



AVIONICS



DATA LINK in SAC handles and makes it expedient to provide fast, secure, ground-to-air communications. System developed by General Electric is called Duxone. It employs pilotless selective calling signals (SCL) and message display, (center) where top row displays "word" messages while those below show digital, flexible format messages. To send message from aircraft to ground, pilot would use pushbutton computer (right) located in walk-in-able panel underneath left console.

GE Tests Air-Ground Data Link for SAC

By Philip J. Kline

Longbeach, Va.—A digital command radio system, intended to improve the speed and security of Strategic Air Command's ground-to-air communications with its bombing bombers and tankers, began its evaluation tests late this month. System was developed by General Electric's Communication Products Department here.

Using the new data link, a SAC command post will be able to transmit messages in digital form over existing Short Order single infrared radio links, which will be discarded in the output of a specific airplane, group of aircraft or in the outputs of all SAC aircraft as desired.

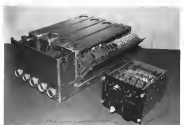
The digital communication messages are expected to get through under all some atmospheric conditions other than those in which might be "ferry" present-and-voice communications according to George Schrey, Wright Air Development Division's Communication Division.

An equally important gain from digital communication is expected when SAC gets its new, automatic control system (AFS-42) using large ground-based digital computer installations (AVF June

30, p. 151). Digital communications system, too, will aircraft navigation and altimeter equipment will enable SAC Control System computers to interpret aircraft and determine their po-

sition and status without human action or intervention in the result as on the ground.

The new, two-way SAC data link, called Digital Selective Communica-



SELECTIVE CALLING UNIT, a portion of complete Duxone system, weighs about 25 lb. including control console (right), but in production use and weight should be less. GE will soon begin evaluation tests with airborne tests dated late test summer.



General Electric's Caravelle is currently being converted to CJ-605-23 40-fan engines at Edwards AFB, California. Prototype aircraft have been designated Caravelle VII.

General Electric Caravelle Begins Conversion to Aft-Fan Engines

EDWARDS AFB, Calif.—The General Electric Caravelle recently arrived at the Flight Test Center here to begin conversion to CJ-605-23 40-fan power propensities to flight testing. The program calls for retrofitting the jet, with first flights scheduled for December.

The G-E Caravelle arrived after carrying over 3000 passengers during a thirty-one hour nonstop flight from Douglas Aircraft Company, Douglas, and will serve the Caravelle in the United States and several foreign countries.

The first two CJ-605-23 engines assigned to the Caravelle program are on hand awaiting modification, with the remaining four engines heavily instrumented. CJ-605-23 powered production aircraft have been designated the Caravelle VII by Sud Aviation.

Each of the CJ-605-23 engines will produce 16,500 pounds static thrust, to boost Caravelle speed and range. The new powerplants will also provide reduced noise levels and shorter takeoffs and landings.

The aircraft's distinctive short-cord nacelles are being manufactured by Douglas at Santa Monica, California. Engines will be mounted in the aft-fan nacelle position. Aft-engine placement will allow the 35% low interest noise level will achieve noise levels in the Caravelle VII.

Based on recently completed flight tests on the CJ-605-23 engine, the Caravelle VII will have extremely low noise levels. Two and a half miles from takeoff roll, or at about 1300 feet altitude, the noise level is 105.5 PNdB at full takeoff power. During approach at maximum landing weight, the noise level is 108 PNdB at 400 feet altitude.

General Electric's Caravelle aircraft nacelle rings jet turbine program, announced last December, is designed to make the Caravelle VII available to the world market early in 1962. For further information on the Caravelle VII/CJ-605-23, check GED-4176. See coupon.

CF700 Completes Two 150-hour Runs

LYNN, Mass.—General Electric's CF-700 turbofan engine recently completed its second unofficial 150-hour endurance run in less than a month. On both occasions, the powerplant bettered previously stated and specific fuel consumption. Guaranteed at 1000 pounds thrust engine is 0.59 lb./hr./lb.

The CF700, destined for the corporate aircraft market, has endurance capabilities which allow the J65 military turboprop with its more than 17,000 hours experience and the PA-44 certified CJ-445-23 40-fan turbine engine.

The CF700 gas generator is virtually identical to the J65, while the CF700 fan component is a scaled-down version of the CJ-605-33 fan package.

Initial testing of the CF700 began in mid-May. Throughout the test program, acceleration tests from idle to full thrust remained below five seconds.

Flight test engines are scheduled for availability in early 1961, FAA-certified engines a year later.

For more information about the CF-700 check GED-4124 and GED-3986. See coupon.

CT58 Certificated for 1000 Hours TBO

LYNN, Mass.—General Electric's CT-58 turboprop engine recently became the first helicopter powerplant to be certificated for commercial operation with Federal Aviation Agency approval for 1000-hour time between overhauls.

The 1000-hour rating, representing more than a year of normal operation, is the longest TBO granted by the FAA for either reciprocating or turbine helicopter engines. The new rating applies specifically to the Sikorsky S-63, which currently carries the first American helicopter to be certificated for commercial operation.

The T58-6, military counterpart of the CT58, passed its qualification test in August 1958. The T58 recently powered a holed Navy RH-53E-1F helicopter more than 1000 flight hours without overhaul, operating about three hours a day for a full year. Parts and components were well within wear limits.

The CT58 and T58 engines power a broad range of modern commercial and military aircraft.

For additional information on the T58 turboprop engine check GED-3974. See coupon.



CT58 powers the Sikorsky S-63, first American helicopter certificated for commercial operation.

Nuclear Flight Propulsion Group Joins FPD

In a move to align operating groups more closely with customer needs, General Electric's Atomic Nuclear Propulsion Department has been assigned to the Flight Propulsion Division, General Manager in David P. Skov, who reports directly to John B. Montgomery, newly-appointed division vice-president.

ANPD has been engaged in the development of a military nuclear aircraft propulsion system since 1951. Successful ground tests of nuclear and engine have been achieved since 1956 on a direct air cycle system.

For information on approaches to general nuclear propulsion, check GED-1544. See coupon.

A3J Completes First Carrier Trials

EVERDALE, O.—The Navy's North American Aviation A3J Vigilante powered by two General Electric J79 engines, recently completed the first phase of its carrier suitability trials.

The working tests were conducted aboard the USS Saratoga off Longport, Fla. The Vigilante made 15 catapult launches and 14 arrested landings during its first carrier demonstration. Pilots tested the Vigilante's powerplants with several "brake" and gear landings. The plane also gave general carrier suitability checkouts, including towing and spotting.



A3J catapults from the USS Saratoga, powered by two GE J79 engines.

The sleek Mach 2 bomber's J79 engines gave the highest thrust-to-weight ratio in their class and provide low specific fuel consumption. The J79 produces more than 36,000 pounds of thrust, jet weights only about 3000 pounds.

B-58 CREW WINS SAC BOMBING TROPHY

IRVINGTON AFB, Tex.—The B-58 powered Convair B-58 Harrier, first U.S. Mach 2 bomber, recently demonstrated outstanding capability in its first SAC bombing competition.

In the bombing competition, top individual score was recorded by Major Harold Conder and his crew from the B-58 equipped 43rd Bomb Wing, The Wing, which had flown the B-58 only six weeks, placed second in one bombing and fifth in overall competition for the Irvin Bomb Trophy, won by B-57s of the 11th Bomb Wing.

The last bombing competition was won by 11th Bomb Wing, while J79-powered B-57s of the 48th Bomb Wing took the navigation award.

Asied by the B-58's ability to start as J79 powerplants while testing other aircraft of the number one engine, the Harrier crew swept the ground attack team competition.



Current view of General Electric's T64 turboshaft configuration, which exceeded all guaranteed specifications in preliminary flight rating test.

T64 Turboshaft Engine Exceeds Pre-flight Rating Test Guarantees

LYNN, Mass.—General Electric's T64 turboshaft engine recently passed its official preliminary flight rating test (PFRT), exceeding all guaranteed specifications.

G-E's Small Aircraft Engine Department, with May Company, ran three official tests on this version of the T64 gas turbine, two on J44 and one on J45-500 in each test all performance parameters, including acceleration times, oil consumption, starting time and deterioration were well within specification limits.

The engine developed 2740 shaft horsepower at military rating with a specific fuel consumption of 0.490 lb./hp-hr. compared to its performance guarantee of 0.515 hp and 0.500 lb./hp-hr.

Test approval of the T64-3 turboshaft automatically qualified the powerplant's direct drive version, the T64-6, for flight testing.



Alert took time hunting for E-3.

Major Conder's winning time was two minutes, twenty-five seconds from launch to take.

The T64-4 and T64-6, turboshaft models of the engine are also expected to receive official PFRT approval later this year.

All models utilize oil-injection power unit and deliver only in reduction gearing and accessories. Under development for the Navy, the T64 is designed for large helicopters fixed wing and VTOL, STOL, applications. For more T64 information, check GED-4094. See coupon.

FOR MORE DETAILED INFORMATION on these and other developments in General Electric products, contact your nearest G.E. Model Propulsion Sales representative or indicate below the first two numbers you would like to receive.

General Electric Company
Sud Aviation
Sudbury, N. Y.

☐ GED-3701 and 4176 "CF700" to follow

☐ GED-3974 "CT58 engine"

☐ GED-3976 "T58 engine"

☐ GED-4108 "Caravelle VII"

☐ GED-1544 "Approaches to Aircraft Nuclear Propulsion"

☐ GED-4074 "T64"

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____



LIQUIDOMETER electronic-electromechanical instrumentation

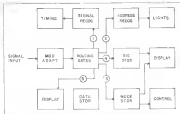
for space vehicles • aircraft • ground support units • test facilities

Liquidometer combines the wisdom of original design with the dependability of long experience to qualify as a major source of instrument and control systems. Capabilities in design, development, and production are outlined in a new Liquidometer booklet available on request.

Your inquiry is invited.

THE LIQUIDOMETER CORP.
DEPT. E, LONG ISLAND CITY 1, NEW YORK

Since 1950  of proven quality



SEQUENCE of Decima signal storage flow and control as routine mode is shown

ness, or Decima for short, will provide the following services:

- "Canoe" messages, providing 36 (or more) channels used to send instructions or replies.
- Flexible format messages, containing up to 48 alpha-numeric characters for special communication situations where canned messages are not suitable.

- Request for voice contact, showing specific loss that aircraft should contact.
- Automatic calling functions which enable a ground station to activate, deactivate or retransmit certain equipment aboard the aircraft or change its operating mode such as IFF (identification friend or foe). This service also can be used to obtain automatic altitude and position reports from aircraft navigation equipment.

The GF system enables individual handwriting (yes, to the instrument crew) or flexible format messages in digital form to use selected ground stations.

The GF Decima system has several characteristics such as flexible format message structure and word-per-second data rate (50 bits per second) which could make it attractive for civil use.

Several months ago the Air Transport Association, in a statement expressing active views on civil data link needs, called the AGNCS data link being developed by Radio Corporation of America as the Federal Aviation Agency sponsor "the nearest it [could] be to the flexible message capability and speed to an extremely high data rate (AW June 29, p. 36).

Prototype Airborne System

The prototype airborne Decima system which GF has constructed for evaluation tests weighs approximately 68 lb. Because equipment is developed on an extremely short timetable of about one year, it does not represent the ultimate in miniaturization. A pro-

duction reference should permit the airborne system weight to be cut to about 35 lb., according to G. A. Koon, Decima project manager. The system is completely transistorized, Koon reports.

Decima Fundamentals

For maximum flexibility in application and use, the Decima system has been designed in the form of two basic subsystems:

- **Selective calling**, called control master group (AN/CRA 2D) which enables ground station to call individual group or all aircraft and transmit up to 605 discrete messages in an arbitrary sequence.

- **Digital message rail**, called digital data group (AN/CRA 2G), which can be added to selective calling subsystem to provide for two-way digital communication of both control and flexible format messages.

In the prototype equipment, the selective calling control unit and its associated cockpit control/display console weigh about 25 lb. The digital message rail and its cockpit message console/display weigh about 13 lb., according to Koon.

Selective calling, from ground to air or vice versa, is accomplished by transmitting a series of four call letters which correspond to the specific code assigned to individual aircraft group or the en route fleet. The four letters assigned can be a phonetic expression of the station identifier similar to technique used in airline baggage tags, or completely arbitrary. For example, code letters for SAC Headquarters might be OHUT, or AGTV.

When ground station transmits a call to an individual aircraft group or aircraft in the en route fleet, the cockpit display of aircraft being called will start flashing. This particular lamp illuminated will indicate whether the call is

QUALITY WITHOUT COMPROMISE
Performance
Flexibility
Availability



VERSATILITY with CONSTANT SENSITIVITY

Veeco's MS-9 leak test stations are used to pressure, vacuum and inside out test hermetically sealed units. The helium mass spectrometer permits sealed objects to be certified leak proof at a sensitivity of 10^{-10} cc/sec.

Veeco manufactures a complete line of high vacuum equipment... Compucon, Leak Detectors, Exhaustors, Systems... accepted as the quality line for over a decade.

Automatically or manually operated.

For MS-9 Brochure or Complete Catalog write Dept. 30-48 

Veeco
VACUUM-ELECTRONICS CORP.
Dorland Drive • Princeton, N.J. 08542
HIGH VACUUM & LEAK TESTER EQUIPMENT

NOW
Test Proven
Seamless Spun
TUNGSTEN
Rocket Nozzles

Marquardt Provides Unique Advanced Materials and Structures Capability for Space-Age Demands

Seamless spun tungsten rocket nozzles have been developed and produced by Marquardt's Advanced Materials and Structures Department. Capable of withstanding the severest combustion environments, these test proven nozzles exemplify Marquardt's continuing materials and structures state-of-the-art advances. In other critical areas, too, Marquardt's unique ability in composite metallurgy and advanced processing methods in producing heretofore impossible-to-form space age hardware.

Marquardt's consistent break-throughs in the ultra-high temperature areas of refractory metals, graduated resistant coatings and metal reinforced ceramics provide customers with a proven record of materials engineering and processing progress.

At Marquardt, "materials" application does not lag behind design requirements. When design engineers demand fabrication or utilization of metals, alloys, and ceramics that will withstand the stresses, strains, and erosion of elevated temperatures, Marquardt provides not only the technical answers, but the products themselves. Fifteen years technological experience gained in research, development and production of chemical and electrical power systems for atmospheric and space flight, are important benefits offered by Marquardt engineers. This leadership combined with extensive modern facilities, provides Department of Defense and Weapon Systems Managers with a unique capability for research, development and production of reliable high temperature materials and structures. Detailed information about Marquardt's experience, facilities and services may be obtained by writing Bill O'Connor, The Marquardt Corporation, 14555 Sandoz Street, Van Nuys, California.

Engineers and scientists experienced in these or related fields will find rewarding to discuss their career futures with Marquardt. The company's growth is a parallel to the atmosphere of challenge and rewarding accomplishment that has existed since the firm's beginning.

SPIN FURNACE (TOP)—Capable of exerting an accurately controlled carbon graphite working torch, 12 1/2 Spin Furnace cold-flow furnaces seamless components up to 18 feet in diameter and 22 feet long.

40 KW PLASMA ARC (CENTER)—Temperatures up to 30,000°F generated by plasma flame may be used for applying ceramic, metal or organic coatings.

TIN-3 TEST MACHINE (BOTTOM)—The auto dynamic elevated temperature testing machine conducts tensile, compression, shear, rupture, compression tests of metals at temperatures up to 3,500°F. Programming of various load temperature time parameters may be performed.



THE *Marquardt*
CORPORATION

14555 SANDOZ STREET, VAN NUYS, CALIFORNIA

KITCO • COOPER DEVELOPMENT DIVISION
• GORDON DIVISION • FORDINA DIVISION
• POWER SYSTEMS GROUP

CORPORATE OFFICES VAN NUYS, CALIFORNIA

individual group or a general broadcast. When the pilot pushes the flashing light, causing it to go out, Deacon transmits an acknowledgment signal containing secret slanting code back to the ground station.

On Target, Because...

B&L optical-electronic-mechanical capabilities help align azimuth on Polaris Submarines

To sharpen the shooting eye of this deadly fish, Bausch & Lomb developed four different instrument systems to convey optical and electronic information between the missile guidance package and the inertial navigation system.

Accuracy of these systems is measured in terms of one second of arc: 1 part in 300,000.

The integrated skills of Bausch & Lomb sped these four Polaris projects through every phase of development: complete original design, detailed documentation, fabrication. We'd like to apply the same skills to your project.

WRITE for B&L Capabilities Bulletin... and for help in the development and manufacture of optical-electronic-mechanical systems. Bausch & Lomb Incorporated, Military Products Division, 10410 Bausch St., Rochester 2, N. Y.

BAUSCH & LOMB



Duoson message (and synchronizes the timing circuit). Signal is then routed to the address recognition circuitry, where comparisons are made with each of the three cells which individual aircraft equipment is set to recognize, or, individual group or groups.

If the message address is one of these three, it causes the appropriate light to start flashing on the cockpit console and signal is then routed to first reader and then to synchronizing circuit. Both the mode control and calling status code letters are then displayed on the console. If the two-letter mode control code indicates that a digital message is to follow, the signal is routed to the proper circuit in the associated digital data group for display on the cockpit console.

Initial tests to be conducted here during the month will be ground-based evaluations of the electronic calling subsystem, to be followed each week by tests on the digital data subsystem.

By mid-1951, Air Force hopes to begin airborne flight tests using electronic calling units modified to show 30 SAC aircraft, nine of which will also be equipped with digital data subsystems. Present plans are to install ground-based Duoson equipment at five SAC stations. The Digital Selective Communications system was developed under Wright Air Development Division sponsorship.

U. S. Plans Tracking Station in S. Africa

Johnson City—United States and Union of South Africa have signed a bilateral agreement for location of a deep space tracking station scheduled for operation early next year, in Western Transvaal.

The U. S. will put the South African government \$2.5 million for a 1,250-acre site, located 24 mi. south of Krugersdorp. Station initially will be operated by U. S. personnel who gradually are to be replaced by South African personnel by the day-operated Council for Scientific and Industrial Research.

National Aeronautics and Space Administration will act as program manager for maintaining the site, which will consist of an 8-ft tracking dish mounted on a 100-ft pedestal. Dish will have an metal ring of 1-in. diameter.

Under terms of the agreement, U. S. firms will build instruments and South African construction will construct facilities.

The deep space network, also will include a station in Australia and a site here at Goldstone, Calif. The three facilities are about equidistant around the earth to provide complete 24-hr tracking of space probes.



THE UNIVAC A.C.T.

A C.T. And to be made! No other automatic component tester could meet the demands of Univac quality control. Univac reliability standards demanded a new means of component testing involving unprecedented speed, flexibility and reliability.

The result was A.C.T. (Automatic Component Tester) which measures and records a component parameter every second—60 times faster than manual inspection.

One of A.C.T.'s early assignments was a 100% check-out of all 90,000 components in a Univac computer system. Each was checked on 10 parameters—a total of 900,000 critical tests. Many thousands of man hours were

cut to a few hundred hours. Human feelings of fatigue and misinterpretation were completely avoided.

But speed is only one of A.C.T.'s many merits. With great flexibility, it automatically measures resistors, diodes, transistors, capacitors and capacitors with absolute protection against damage during testing.

A.C.T. is currently on an 18-hour day, six-day week in the continuing mission of Univac reliability.

Univac reliability insured on the operation of A.C.T. Univac ingenuity and capability produced it.

Military Dept., Remington Rand Univac, Division of Sperry Rand Corporation, Univac Park, St. Paul 16, Minn.



* CAPABILITY-INGENUITY-RELIABILITY for Business, Industry and Defense at REMINGTON RAND UNIVAC

UNI-FLEX

ADVANCED TECHNIQUES IN EXPANSION JOINT FABRICATION

U-SHAPE BELLOWS FOR HIGH PRESSURE, HIGH TEMPERATURE SERVICE
Uni-Flex manufactures expansion joints in all sizes and shapes for Refinery, Pulp, Chemical and Processing Applications. In the large diameter U & J type cradled and braced joint is available without, angular and rotational displacement due to high temperature and pressure. Manufactured in a very efficient way.



LOW PRESSURE CONVOLLUTES AND BELLOWS FOR CHEMICAL SERVICE
Uni-Flex convollutes are hydro formed from single or multi ply material with emphasis on low service rate and pressure loss. The low reaction forces result from many close pleated and multi ply convollutes. Further design and better flow characteristics are possible with this design.

DESIGNING AND MANUFACTURING TO CUSTOMER SPECIFICATIONS

Other Uni-Flex Lines Include:
COMPLETE CHEMICAL SYSTEMS FOR
ULTRA-HIGH TEMPERATURE AND PRESSURE
HEAVY DUTY PUMPS & EXCHANGERS
PLASTIC PROCESSING EQUIPMENT TO
RESEARCH INSTITUTIONS

For Complete Information Write Day 1 C-3

UNI-FLEX
MANUFACTURING & ENGINEERING, INC.

1945 E. Shawnee Avenue - Los Angeles 22, California
Order Desk 5-HETD

FILTER CENTER

► **New Eliat Technique**—Considers new technique capable of determining unknown radio's technique when 1/8 and detector both accurate and constant—to within 1 deg. in low developed in Electronic Specialty Co., Cleveland, Ohio. Necessary data can be obtained from a single order probe, requires no equipment employing the technique would weigh 30 lb., occupy about 1 cu. ft., according to the company.

► **Dual-Purpose Satellite**—Early satellite system which could provide both communications and emergency communications with a satellite location will be prepared soon to a number of satellites, agencies by Electronic Specialty Co.

► **Occulting Studies Project**—The occulting construction of semiconductor oscillators—a being investigated by RCA Laboratories in a possible solid state frequency selective amplifier. Part outlined of the Solid State Device Research Conference by R. D. Lenzinger of RCA, the oscillator consists of a semiconductor junction subjected to a magnetic field and connected through a dc power supply to a load. Frequency of oscillating voltage at the load are determined by capacitance and construction of the magnetic and electric fields and the surface condition of the semiconductor. Work is now sponsored by a grant from Wright Air Development Division study contract number Motorola Variable Amplifiers and Solid State Amplifiers.

► **West Coast Solid-State Research Conference**—Began Series of West Coast solid state device research conferences got under way on Oct. 20 and 21 at Stanford Research Institute. Sponsored by the West Coast Subcommittee on Solid State Devices of the American Institute of Electrical Engineers and the Institute of Radio Engineers Professional Group on Electronic Devices, the event will explore many facets of research in semiconductor, magnetic, and electro-optical devices. Meetings are open to scientists and engineers who agree not to photograph slides or take notes so as to avoid trade exchange of early or tentative research results.

► **Micromodule Components Division** has been formed by Long-Term Electronics, Inc., Dallas to design, produce and market logic circuitry modules for integrated computers, custom scale semiconductor components and high and low voltage rectifiers. Division will be

based in space based at 1977 So. Manchester Ave., Anaheim, Calif.

► **Al Faus** declared the first Electric Machine Week, warning system status at Thule, Greenland, operational Oct. 3. Several BMEWS stations at Clear Alaska is scheduled to become operational next summer.

► **General Electric Machine and Space Vehicle Department** will build a solar test facility near Phoenix, Ariz., which will permit testing of the largest solar-powered static generating system now being built for space applications. Facility is to be ready by February.

► **Hamilton Standard Division of United Aircraft** will produce a dual reducing roughness system for the submersible isolated ship being developed for the Navy by Boeing Aerospace Co. (NAV Sept. 18, p. 171). System would include a new system electric navigation analog computer, day's course indicator display and distance indicator, and thrust control units, including engine and bearing transient test.

NEW AVIONIC PRODUCTS

► **Alpha-Numeric readout modules**, capable to 70 ft. display size. English-alphabet letters and any numeral from 3 through 9 in character 3 in high, 2 in wide. Indicating segments are white against black background. Operates on low power d.c. signal, from 1 to 10 v., with response time of less



than .01 sec. Two basic types: 285 (monochrome) and 294 (monochrome or photoconductive lighting). Modules, which can be fitted together in panel mounted, measure 3 1/2 in high, 2 1/2 in deep, 1 1/2 in wide. Manufacturer: Altek Instrument Corp., 145 E. 2nd St., Minnoka, Long Island, N. Y.

► **Voltage-to-frequency converters**, called Magnavox, produce output square wave whose frequency is directly proportional to applied (input) voltage. Input-output linearity is within 1% in standard configuration, while "Red Line Magnavox" has linearity of 0.1%



RADAR-BUSTING is our business

Bendix-Pacific Division and Bendix Research Laboratories have developed an accurate family of anti-aircraft guidance and detection systems—available in a wide variety of configurations for numerous applications in aircraft or missiles. Our engineers are available to discuss your specific requirements.

Bendix-Pacific Division
BENDIX CORPORATION



with temperature stability better than 50 ppm/deg. C according to nominal size. Eight standard models provide full range of output frequencies, from 50 cps. to 25,000 cps. Maximum full scale frequency is adjustable over a 4:1 range with built-in attenuator. Shielded metal base input voltage range of 0-1, 0-10 and 0-100 v. The three adjustable output currents approximately 10, 50 and 500 μ A. Manufacturer: Precision Magnetics, Inc., 610 Pen Blvd., Santa Monica Calif.

• Multicore tape perforator, strength tested for use as ground support equipment operates at speeds from 0-18 mil/rev. per second on standard code drum.



with 5, 6, 7 or 8. Perforator is available with punchers for multitrack master tape. Manufacturer: Teleconcepts Corp., Data Instruments Div., 12315 Selma St., North Hollywood, Calif.



• High-power X-band klystron, Series VAK-10, rated at 30 kw continuous wave (CW) for applications requiring very low AM and PM residual noise is called highest CW power klystron ever offered for X-band by manufacturer. Klystron cover frequencies range of 7,125 to 8,190 mc, are tunable over a 60 mc band, provide power gain of 17 db and maximum bandwidth of 50 mc. The multistage tuned power gain and bandwidths are 55 db and 35 mc, respectively. Tubes are housed electrically shielded. Manufacturer: Varian Associates, 611 Hansen Way, Palo Alto, Calif.

• Miniature telemetric power amplifiers, Type 1114A/1114B, with 15 watts output, weigh only 34 oz. Amplifier operates over entire 215 to 268 mc side with load at altitudes up to 130,000 ft. Manufacturer: Tele-Dynamics Div., American Bosch Arma Corp., 5900 Parkway Ave., Philadelphia, Pa.



Radar-Oscilloscope Camera Processes Film

Radar-oscilloscope strip film camera processes film within the scanner in first second without need of processing solution. The variable speed camera, with transport speed range of 0.25 to 125 in./sec., has 70 mm. film in length up to 100 ft. Camera and processing unit weigh 85 lb. Decoder will be available in January. Manufacturer: Chicago Aerial Industries, 510 West Northwest Highway, Burrage, Ill.



MOTOROLA Military Electronics Division

CLOUD 9 ASSEMBLY LINE

RELIABILITY is designed into Motorola military electronic systems and equipment from the beginning... not patched on later... an inherent characteristic of all Motorola products for three decades. From cloud nine to assembly line, from original concept to completed military contract, uniform, dependable performance under severest operational environments in more than an objective... it is an obsession at Motorola. This spirit motivates 850 top scientists and engineers and more than 3000 technical specialists in all, deployed at Motorola's six wholly-owned facilities, exclusively engaged in electronics for defense.

Consistent reliability is a broad aim of military electronics programs because Motorola's reputation and responsible roles in these, and other advanced fields.

- All New Communications Systems & Equipment
- New Transmitters, Receivers & Display Programs
- Missile Systems, Guidance & Instrumentation
- Electronic Warfare & Countermeasures Programs
- New Electronic Warfare Systems & Equipment
- Guided Missiles & Development in Missiles/rockets
- Microwave Radar & Sensor Instruments
- Short Wave Transmitters & Receivers & Jammers
- Ground Air Systems & Equipment
- Communication Systems

For more detailed information, a comprehensive brochure will be mailed on request.

Qualified technical personnel recruited to join recognized leaders in many fields of science at Motorola... and share in solving complex military electronics research, development and production problems. Write to the man of your choice.



CORPORATE HEADQUARTERS
1400 NORTH CIGERO AVENUE
SADDLEBROOK, INDIANA
46081
WEST GATE MILITARY ROAD
SUNDERLAND, CALIFORNIA
95506
A DIVISION OF MOTOROLA

MODERN DEFENSE IS ELECTRONIC

All types of America's present and future defense forces — Air Force, Navy, Marine, and Coast Guard — would be improved with electronics. Drawing aid, timing, tracking, guiding and firing of missiles — all require electronic equipment of ever greater sophistication. Every piece of B-10 equipment, at least, requires thousands of hours of thousands of electronic vehicle maintenance. Transistor — America's leading producer of quality semiconductor — is steadily developing more reliable and more versatile semiconductor in application of tomorrow's defense needs.

wherever there's electronics...there's



Transistor

TRANSISTORS, DIODES, RECTIFIERS, UNITS, REGULATORS, REVERSED, RECOMBINATIONS, TRANSISTORS, ELECTRONIC
TRANSISTOR electronic equipment — solid state, silicon, germanium — also other in product lines throughout the U.S.A. in 1964 — 1965 edition. TRANSISTOR

SPACE TECHNOLOGY

Oscillating-Electron Ion Engine Tested

By Michael Yaffee

E. Hartel, Conn.—United Aircraft Corp. has entered the fast-growing electron rocket propulsion field with an "on-axis" oscillating-electron beam-hybrid ion source that produces a high velocity, electrically neutral plasma beam.

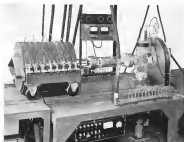
United's Research Laboratories, which developed the ion drive with ionospheric thrust, now has a research and development contract from the Air Force Research Division of the Air Research and Development Command to investigate the operating mechanisms of the device. The contract is to run for 15 months and, it is hoped, will lead to a development contract.

Principal attraction of UAC's ion drive is its reported ability to produce an electrically neutral beam. This eliminates the space-charge after-effects of an electrical charge on the vehicle which would draw the oppositely charged particles back onto the vehicle instead of generating free cut into space—which limits the beam current or power of many of the other proposed ion rocket engines. This means that theoretically there is no limit to the thrust capabilities of the UAC device and that depending upon the availability of a suitable nuclear reactor or other power source, it could produce over 1,000 lb. of thrust if desired, according to UAC scientists.

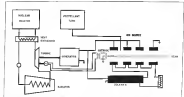
Strong Competitive Factor

Moreover, they feel that this particular ion drive gives UAC a strong competitive position with other ion engines whose ion engines still require development of means to successfully support "oscillating" electron downstream. Demonstration model of the UAC ion engine could be flown in a satellite within two years using a battery power source, into the company. First actual application of an ion engine is expected to be in the proposed 14-lb. communications satellite, which as an engine, probably powered by the North American Aviation SNAP-3 nuclear reactor, will be used to boost the satellite from a near-earth orbit to a "stationary" 22,000-mi. orbit.

At the present time, there are four oscillating-electron ion sources in operation at United Aircraft Corp. Research Laboratories here, each capable of producing up to 10 lb. thrust according to company scientists. The first unit, which was built originally for in-



WITH SOLIDIFIED CAST solid bell, United Aircraft Corp.'s oscillating-electron ion engine can be seen above made glass vacuum system used to deaerate upon environment



COMPLETE electrical propulsion system based on UAC ion engine is demonstrated above. Scientists at UAC Research Laboratories electrical propulsion facility (below) check those of the group's first ion engine test results.



COLLINS
ALPHA

CAPTURE AN 'ECHO' TO BEGIN A NEW ERA IN RADIO

COLLINS, ALPHA CAPTURE AN 'ECHO' TO BEGIN A NEW ERA IN RADIO COMMUNICATION

The first two-way voice communication using the Echo 1 satellite was made by Collins Radio Company in Iowa and its systems subsidiary, Alpha Corporation of Texas. Collins also conducted signal measurements, relayed teletype messages and even a news photo. Participants in NASA's Echo project are representative of Collins' space research. They studies involve upper atmospheric radiation, and systems evaluation associated with space vehicle programs, including a lunar "net" landing. Collins also designed the first radio antenna and provided communication systems for Transit Mercury and the X-15 rocket ship.

Challenging opportunities for engineers and scientists at all levels



COLLINS RADIO COMPANY
ALPHA CORPORATION



Bell, New • Cedar Rapids, Iowa • Burbank, California

it is reasonable that other electron driven work in the vacuum market will require potentials as high as 50,000 volts. Among other things, it is claimed, this will make the cathodeless electron device more compatible with low voltage frequency and characteristic with and could result in considerable savings in weight.

Then, it, of course, still a great deal of work to be done before the multi-electron ray device becomes a realistic reality. Among the problem areas and little understood phenomena currently under study or tested for future investigation have at United Aircraft Corp. Research Laboratories on the following:

• **Design of the potential "well" and "hill"** is in effect to obtain greater thrust. UAC scientists are experimenting with different electric field shapes, seeking ways to increase ion current while maintaining a relatively constant ion energy distribution.

• **Thrust loss.** Related efforts are under way to understand and reduce the phenomena of thrust loss caused by ions going to the cathode instead of out the other end. By altering the shape of the electron field, among other things, UAC researchers hope to reduce ion loss to the cathode at least to 10%.

• **Spitting.** A problem common to most chemical propellant nozzles, spitting is caused by the highly accelerated particles ions that hit the cathode and knock off chunks of material. UAC researchers hope to eliminate this problem again through better electron field design and through use of stronger cathode materials, different cathode designs and different propellant injection ports.

• **Emission loss.** Some existing electron guns are lost quickly to the anode, coating heat and having done little useful work. This also means that more current has to be supplied to the cathode so that new electrons can be drawn off to replace those that are lost again through supposed "well" design and selected optimization, researchers hope to trap electrons more effectively.

• **Efficiency.** UAC scientists are working on ways to improve the overall efficiency of their ion drive. The overall figure is actually derived from two components, working fluid utilization efficiency and power conversion efficiency (heat power/output power).

To improve propellant utilization efficiency (that is, maximize the amount of working fluid that passes out of the device before it is ionized) and power conversion efficiency, experiments among other things are varying the shape of the potential "well," strength of the magnetic field, gas pressure, gas feed points, cathode and anode design, and voltage levels.

Large Solid Booster Study Areas Assigned

Washington—Three companies selected to conduct preliminary design studies on solid propellant boosters weighing 1 million and 7 million lbs have been assigned specific study areas by NASA.

General Coastal Rocket Co. will study and design a million-pound first stage, Thiokol Chemical Co. has been assigned the 7 million lb first stage, and Aerojet-General will study and design stages for vehicles in both weight classes.

Solid propellant super booster stages theoretically can have thrust levels two to three times the vehicle weight, and the NASA studies are being conducted to determine the ability of solids to compete with chemical stages in Saturn and Nova booster classes.

The three firms will conduct independent air-month studies. They will share approximately \$125,000 in the contracts (AW Sept. 19, p. 20).



Argos Flare Carrier

Aerobik Development Co.'s Argos E-5 will be used to carry this outgrowth to 1,200-m. altitude in mapping experiments to begin in January at Wallops Island, Va. USAF project includes use of widely spaced cameras which will use triangulation method to determine the most accurate between observations. Aerobik is conducting test firings and pretests.

252



Today is obsolete...

The "breakthrough" of every century symbolizes the day-to-day use with observance which challenges our status and its scientific basis. While every achievement today represents progress, no technological group or organization can rest on its laurels at the highly competitive cold war era. To reach beyond today's horizon, with discoveries that are meaningful for tomorrow, is the goal of Sperry research. Toward continued progress in air and sea transportation and its critical aspects of national defense, our program encompasses research in depth under such headings as electronics, robotics, gyroscopic phenomena, electron beam radiation, materials sciences, mathematic analysis.

To some, the promise inherent in much we explore today may sometimes be hidden in such exotic terminology as supersonic/hydrodynamics, cryogenics, spin movement, gas pulsation, plasma physics. In these and other fields, our resolve to bridge the gap between initial inquiry and realistic application will expedite the widespread application of these new technologies.

Research at Sperry will make continuing significant contributions to our rapidly expanding environment in the nation and the free world seek a more peaceful and meaningful way of life. General Office: Great Neck, N. Y.



has submitted a recommendation to Prime Minister Harold Wilson for the provision of space science and technology.

In his report, Dr. Keeselroge urged funds to approve three projects to be conducted in Fiscal 1965 and 1965. •Complete and launch Kappa 9 type observation satellites, now being designed by Tokyo University's Industrial Science Research Institute in Fiscal 1961. Kappa 9, carrying 152 lb. of observation equipment, is said to be able to attain altitudes of from 186.4 to 240 mi.

•Start designing and manufacturing Kappa 10 type rockets which will be capable of reaching the same altitudes as Kappa 9, carrying observation equipment weighing from 44 to 66 lb. Sources said a total of 20 Kappa 9s and 10s will be built at a cost of \$2 million in Fiscal 1961 and 1962. Observation equipment includes a 35 mm television camera, radio transmission device, and other measuring instruments.

•Complete in Fiscal 1962 a portable receiver about 50 lb. in diameter, and a receiving apparatus of the British Science Ministry's Radio Technology Research Institute in preparation for space communication devices which will be manufactured in 1962.

•Start manufacturing technological observation satellites and balloons, which will be capable of carrying minimum 244 mi. in Fiscal 1962 and launch them in the following fiscal year. •Begin designing an artificial satellite in Fiscal 1962 in preparation for such a time when Japan reaches launch capability.

WHAT'S NEW

Publications Received:

Countdown—The Story of Cape Canaveral—W. H. R. Stebbins—Little, Brown and Co., Boston, Mass. \$5.95 181 pp. A book for young people explaining the launching of rockets. This history of rockets and life at Canaveral are included.

Partial Air Navigation—Vladimir C. Lina, Constantin-Werner System of Navigation, Inc., Newington, N.H. \$4.00 151 pp. paperbound. The complete edition of the famous Civil Aeronautics Bulletin No. 24. Study guide for all FAA pilot ratings.

Learning to Fly—John H. Holland—Holt, Rinehart and Winston, Inc., 151 Madison Ave., New York 17, N. Y. \$4.00 256 pp. Written in accordance with the latest FAA licensing procedures. Includes instructions for controlling speed, rolling, turning, banking, etc.

Hawker Siddeley Aviation LIMITED

* ENGLAND *

AIRCRAFT GUIDANCE AND GYRO SYSTEMS

Greater strength British England requires a faster response equipment for the guidance and the direction control of aircraft. In this is being engaged in developing Weapon Systems for the Hawker P.1127 VERTOL low altitude attack aircraft.

A background of experience with gyro technology is essential and a knowledge of advanced electronics and low control systems would be helpful for the above.

Applicants for the senior position which carries Director's Salary Scale, experience are asked to indicate the salary expected and availability for employment. All necessary references may be arranged in this country but detailed applications should be sent to the first instance to:

Mr. E. L. CHITTY, Personnel Supervisor

HAWKER AIRCRAFT LIMITED

RICHMOND ROAD, KINGSTON-UPON-THAMES, SURREY, ENGLAND

*a weight ...
is a weight ...
is a weight ...*



For the first time, but that moment when it arrived our feeling that there is no more fundamental standard for weighing force. International fixed scale, if you prefer, there is no of fixed weights. We make all types—Revised dual beam, Revised single beam, or direct read weight, and in any of these types you can have other specialized weights giving a small number usually 100 lb. or more, or heavy weights giving the possibility of 1000 equal steps with ten weights (to over 12,000 steps by using 10 weights). We can furnish these for laboratory use, or built right into a plant used for field calibration. We like to send you our literature or send a sales engineer to discuss your application. And write us well.

Autotest

2012 E. Olsen Dr. • Santa Ana, California
Monday 9-11:15 • Mailing 9-11:15

between craft and industrial areas and with even more highly complex disagreements between craft unions, due mainly to strengths in general construction contracts in store in on industrial jobs. [AWF Oct. 1, p. 38]

Rate of Progress

At the present, the construction program is about one-fourth complete. From a current level of \$400 million a year, the rate of spending will speed up to about \$1 billion in Fiscal 1962, as late construction and activation. Completion date is 1965. The Atlas program is well under way. Early Atlas will be in overland "cutoff"

before being used for firing, and later bases will have them based in also but raised to the surface for launching. Time it needs will have a smaller size arrangement.

Time it needs will be first directly from their site. After operational base have been completed at Vandenberg AFB, Calif. and at Warren AFB, Wis. (Like the Titan II, the solid-fueled Minuteman will be fired from underground silos.) First move is trying to increase storage in construction installables and make late last year when the Air Force set up the Aerospace Base, headed by Air Materiel Command Commander

Gen. S. E. Anderson. Completing its work five months later, the base now completed second stage to be taken to speed the work.

First contract call of the survey came when the Corps of Engineers, Ballistic Missile Construction Office, was created Aug. 2 with headquarters in Los Angeles at the same building with the Ballistic Missile Center of the Air Materiel Command, which took over management of ICBM as activities in Feb. CEBMCO was put under Brig. Gen. A. C. Walling, former Engineer, Commander of the District of Columbia, and made solely responsible for construction program conduct administration.

Since then, projects have been turned over to Walling's office from Corps of Engineers District where they formerly had been administered. The shift was scheduled to be completed in November.

At the same time, the Ballistic Missile Center under Gen. Gorman, by using the central clearing house for the Air Force, integrating the functions of the Air Force Civil Engineering Directorate, missile construction equipment construction, and the Ballistic Missile Division of the Air Research and Development Command.

ARDC Role

From its transfer of control to ARDC, the site activities have been assigned to the Ballistic Missile Division of the Air Research and Development Command, which kept it until late in the year when it was turned over to the Strategic Air Command. Now ARDC administers the two and RADC supervises such site activities factors as concrete rise, installation and checkout of the system, and adherence to specifications. In order to permit ARDC to prove and utilize and concrete changes, the contract would have returned control over the site activities of the Vandenberg AFB, Calif. base, once one and two at Warren AFB and Offutt AFB, Neb.

In the July 14 conference with Gates, the construction generated a list of comments and suggestions which were shared with the Defense Department. Late in September, action on these items was completed in a memorandum.

Principal complaint of the general contractors was too many bases. They suggested that since their contracts were with the Corps of Engineers, the Army have sole control of construction. Subsequently, CEBMCO and its contracting office at the major activities to deal with a contractor has reviewed this complaint to the satisfaction of the contractors.

Another source of criticism was work and other conditions at sites selected. It was stated that many were located in heavy water or rock conditions

when suitable sites were only a short distance away. One example given was a complex rock fracturing site in these states, causing the contractor to deal with them, and site two.

Difficulties related that one solution is an optimum combination of factors such as separation, distance, location and density of population areas, access, ability for continued support, and soil composition. In some instances, criteria have been reduced but all set under constant review.

Debt Was Available

It was pointed out that soil borings and geologic and weather conditions reports were available to contractors before bidding and that if conditions were different from those submitted, contract modification necessity was set up to handle such situations.

With the construction going on at the same time in the development program, changes, unless become a problem. These changes were a result of changing requirements in the missile system developed. With more firing at an Atlas, the construction contractor changed, they received a state of change notice. They asked for a reduction in the number of these notices and the authority to propose alternate methods of accomplishing these purposes. Continued management of the program was allowed in a solution to this suggestion.

Another source of contractor complaints was multiple inspections. Not only did these inspections from late reliable time, but they produced considerable delays. Although there is now a control inspection procedure, there still are separate inspection teams representing the principal parties interested in site activities. But these sub teams do not get into the same kind of control with the contractor.

Clearly related to inspection are measurement, references and points, or checklines, centers. Contractors, except for these involved previously in checkline plant construction, were not

Small Missile

Washington-Bureau contract is being granted in Air Force and Army headquarters for a small missile, solid-propellant, tactical ballistic missile (CBM) with a range up to 1,200 mi.

Project would be in being theories at operations, where each is actively known and better are light. The missile would have a weight limit of about 10,000 lb. The project would have some precedent in an earlier study made at Air Force's Ballistic Missile Division about a year ago, time which is specific hardware considered.



Martin Parthian, U.S. Army's mightiest, most mobile selective range missile, holds a fast record of consecutive successes attributed to its history of Cold War survival.

MARTIN

NEW PYLE STAINLESS STEEL MIL-C-26500 CONNECTORS*

True Connector Reliability

Here is a connector, lightweight connector so highly resistant to extremes of temperature, vibration and altitude that it provides, at last, true connector reliability for air, missile and space systems.

The stainless steel shell encloses with the Pyle Perma-Seal connector, rugged aluminum shell with at least five times greater durability of wearing surfaces, has absolute corrosion resistance with no surface oxidation, maintains high strength at operating temperatures.

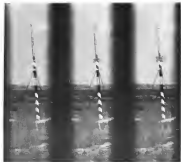
*Specification Federal MIL-C-26500 (AUGUST 1960) with no connector alterations.

DESIGN CHARACTERISTICS

- Comp. type, removable, snap-in contacts in MIL-C-26500 securely sealed and protected by metal shell.
- Collaps, fully protected against loss and shock damage, controlled against deflection.
- Rapid insert pins provide firm contact to support, positive control of axial location and draw.
- Insert factory bonded to shell. Wire welding independent of shell draw.

P THE PYLE-NATIONAL COMPANY
1665 N. Emerson Ave., Chicago 12, Illinois
District offices and representatives in the principal cities of the United States
Manufactured in Canada by Pyle National
(Canada) Ltd., Toronto 18

OVER 25 YEARS OF EXPERIENCE IN THE MANUFACTURE OF ENVIRONMENTAL RESISTANT EQUIPMENT



Rocketdyne Tests New Sounding Rocket

First test for launch of Rocketdyne solid-propellant sounding rocket (AW Sept. 12, p. 37) have been conducted successfully at Ft. Hood, Tex., as a Hough wind, both rockets climbing to 1,500 ft. and then impacting within 100 ft. of each other. Tests were conducted using distribution-propellant gases with solid-fuel combustion chamber propellants the vehicle is designed to carry a second payload to 750,000 ft. Former project of Ft. Hood trials was to check stability of the rocket as it left the launcher tube, which also serves as a dropping container. Photo shows highlights light out of rocket as sounding rocket, which made a short test of the lower tube (center photo). Sound test today was made using a third prototype of the rocket's solid-fuel launching tube, featuring solid-state system was designed, built by Rocketdyne's Solid-Fuel Propulsion Division.

familiar with the mechanical standards required for engine storage and transport systems. These standards specified that only portions of systems are to be tolerated and that the metal parts in the system must be capable of withstanding a substantial range of temperatures.

Problems and Solutions

Other contractor accommodations and Protagon's actions included the following:

- **Selection of an architecture representative at each site to expedite approval of shop drawings.** This has been done.
- **Contract the competitive bid, low-price type of contract awarded to the lowest qualified bidder.** The ground contractor, considered to be a private building, picked out the negotiated contract with its fixed fee. In the overlap period when a general contractor is finding his job and the usual contractor comes in to complete the main building installation, the difference in operating procedures became a source of irritation because the main

site production system is fixed for materials, and, according to the general contractor, do not practice common to in part or extent affecting construction complex, annual.

- **Coordinate site activities program for structure and mechanical contracts which originally was made separately.** This has been done.
- **Accelerate payments to be made after change orders were made in contracts.** Contractors complained that the payments were slow in coming. A two-step system was established, providing for a minimum payment immediately and negotiation for the entire cost in the second step.

• **Greater use of contractor equipment.** Air Force agreed that to achieve the degree of time-savings needed, the amount of government-owned equipment could not be reduced.

Contractor Completion

In the rush to complete the base, it was noted that some contractors were plagued into situations beyond the capabilities of their organizations. Although there were no completely un-

qualified bidders, it soon became apparent that there were some degrees of competence among the contractors and that a screening system was urgent.

Not only will the prime bidders be screened, but subcontractors will also come under scrutiny because the fast use of one small thing off a whole construction schedule. Capital resources, performance record, current workload, and managerial and technical capabilities must be considered. Joint ventures must be presented.

Program Forecast

With the establishment of control control, many of the contractors' employees have been assigned and the construction program has been speeded to the point that the time formerly lost has been made up and the Air Force anticipates that the program soon will be ahead of schedule.

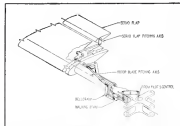
With labor leaders having admitted that they would keep labor's hands in order and contractors admitted that the adjustments made in contractual relationships through having one agency responsible for ground contracts, the Air Force now believes that the "show us on the road." One official stated that after the links have been moved out of the test for installations, the main program will proceed at a pace which would be the nation's ballistic missile defense power at a point level within a year.

AF Transfers Missile Functions to Norton

Washington—Air Force is transferring some elements of its Ballistic Missile Defense and Ballistic Missile Control to Norton AFB, Calif. to provide more room for space activities at the BMD-BMC facilities in Ingleside, Calif.

USAF is transferring BMD-BMC operations functions and certain other ballistic missile functions to Norton, but missile and space system research and development functions will remain at BMD-BMC in Ingleside. About 100 BMD-BMC and BMD personnel will be moved to Norton missile, with 100 to follow next year.

Under the BMD-BMC transfer, the advanced parts and air activities group will move between Nov. 1 and Dec. 15 status weapons system functions, plus other functions and personnel will move between Dec. 15 and Feb. 1. Titan I functions plus other functional and staff personnel will be shifted Apr. 1. Missiles personnel in the office of the commander and other staff officers to be transferred are to complete five years in June 70 and all Titan II and Minuteman functions are to be moved in 1962.



HU2K feedback control linkage must blade gear load losses on Kanan HU2K-1

HU2K Flap Linkage Cuts Blade Loads

Asynchronously actuated pitch feedback control on the servo flap linkage of the Kanan HU2K-1 Starfighter helps control suction flap loads and profile power requirements for increased speed and range.

The pitch control system on the HU2K Starfighter is made necessary by increased stroke and collective pitch range on the high-speed vehicle. The control linkage system reduces gear loads on the blade by exerting opposite forces to return the blade to the command setting. Mechanical spring forces are not employed to stabilize the blade.

The pitch feedback control incorporates a walking beam attached to, and pivoting on, the rotor hub which carries but does not pivot with the servo flap controlled blade. Mechanical linkage to the flight controls permits the pilot to set the walking beam for the required pitch setting. A bell crank-lever in the walking beam pivots on the rotor blade and maintains the pilot's control command to the servo flap.

The control linkage forms the bell crank to return with respect to the walking beam in the event an air gust or other disturbance causes the rotor blade to twist. In doing this, the bell crank causes the remaining control linkages to move the servo flap in the correcting direction. The pilot controls the walking point of the pitch and the aerodynamic spring returns the distorted blade to its proper position.

The aerodynamic spring permits the aerodynamic to operate at lower total lift levels, reducing stresses in the flap and supporting structure and is in position of the blade influenced by the flap

structural attachment. Kanan says that the pitch feedback servo control system serves prevent suction-induced levels and alleviates blade tip stall at high speeds. Another advantage cited for the system is that flap loads remain proportional to blade loads as altitude is increased, making the feedback control effective throughout the HU2K's altitude range.

RUSKA PRESSURE INTENSIFIER

furnishes output pressures to 15,000 psi (output input pressure ratio of 50 from relatively low pressure sources).

- Compact, rugged, portable
- Precision construction
- Corrosion-resistant
- Minimum maintenance

Write for new literature

RUSKA INSTRUMENT CORPORATION
821 Palmdale Blvd., Palmdale, Calif. 93550
Mail Address: P. O. Box 300, Palmdale 93550, Texas

AVIATION WEEK BUYERS' GUIDE

**The Only Complete Guide
Serving The Entire Aerospace Industry**

Contains over 50,000 manufacturers' product listings in 1,800 product categories.

MAJOR PRODUCT CATEGORIES INCLUDE:

**Aircraft • Avionics
Space Vehicles & Missiles
Support Equipment & Activities
Airport & Airline Equipment**

PUBLISHING DATE: Mid-December

NEW AVIATION PRODUCTS



Ground System Air-Conditions Parked Aircraft

Ground air-conditioning system at James Carter Field, Ft. Worth, Tex., provides ground cooling for a Convair 440. The latest type vehicle eliminates the need for air-conditioning on trucks and ground operation of aircraft cooling systems. Flexible tubes attached at 29 locking stations extend to 12 ft. to duct the GSU cooling air. The self-contained ducts are produced by the Flexible Tubing Corp., Guilford, Conn.

Metal Seal

Metal seal is intended for testing applications which experience wide temperature variations. The seal, called Bar-X, is said to withstand temperatures from -410 to 1,200°F and peak pressures of 40,000



psi. The "X" configuration seal, reported to provide elastic deflection and high cooling forces, has provided zero leakage from some temperatures to 1,000°F with air at pressures of 1,000 psi in a static seal application.

Waggon Corporation, 3424 E. Olympic Blvd., Los Angeles 25, Calif.



Flight Test Camera

Weathered stress and long exposures during flight of the North American X-15 are handled with two latest cameras. Other applications include missile and satellite testing.

The camera measures 7 in. long, 4 in. wide and weighs 5 lb. Equipped with a pulse-coat mechanism, the camera records the stress changes on film at a predetermined number of frames per second to record the material changes as wing surface vibrates. Vought Corporation, Beverly Hills, Calif.

Executive Aircraft Generator

Generator for business aircraft provides 100 amp. of direct current at an output range from 3,000 to 5,500 rpm. The unit will be on all new Aero Commander

models 500P and 600P models and will be available for retrofit.

The Model 3009 generator rated at 100 amp, 36 v. is intended to handle increased electrical loads and to eliminate the necessity of carrying high current cables for voltage compensation while taxing. The weight of the generator is 30 lb.

Jack & Elmore, Inc., Box 6917, Cleveland 1, Ohio

Ground Power Truck

Self-propelled ground power unit is designed to supply electrical power to transport aircraft. The power unit is under evaluation at Idlewild Airport. The Hobart Model 5165, powered



by a GMC Diesel engine, is rated at 125 kw, 0.8 gal. three phase, four wire, 420 cps. The enclosed control unit is 71 in. high. Noise levels are reduced by the use of a centrifugal blower and two mufflers. Hobart Corporation, Troy, N. Y.



Vibration Mount

Vibration isolation mount is intended for small equipment and instruments on jet aircraft.

The elastomeric mount is said to provide elastomeric protection against high-frequency vibrations. A typical mount, the BL-2705, weighs 6.5 lb., supports a pressure transducer weighing 1.5 lb. The system incorporates

four Multigrip enclosures in a variety of sizes, depending on which product from vibration from -60 to +1300. Natural frequency is 45 cps. Laid Manufacturing Co., Erie, Pa.

High Pressure Bleed Valve

Valve, to Minimize a high pressure jet or hydraulic system is intended for bleeding high pressure steam out of an

engine, turbine or boiler. It is designed for high pressure, on demand, on aircraft. The P-100 valve has an operating pressure range of 8 to 5,000 psi, low pressure range is -5 to +3,000 psi, weight is 0.6 lb. The size of the valve is from 40 to 50 mm. at 3,000 psi pressure. Valve is of chrome plated stainless steel construction.

Jones, Fred & Clark, Inc., Portland,



Phillips Designs Underwing Fuel Trucks

In fuel trucks at Republic Field, Denver, Colo., are modified to fuel other Boeing 707 at Douglas DC-6 jet transport. Confined Airline Boeing 707 (above) is fueled by two trucks spotted at the aircraft's wingtips. United Air Lines Douglas DC-6s (below) receive underwing fueling from trucks spotted between engine pods on both wings. Trucks were designed by Phillips Petroleum, the fuel supplier. Capacity is 27,000 gal., which can be pumped at a 600 gpm rate.



how would you use

one of the largest privately owned facilities in the nation for research and development of your GRE?

phone...

... Mr. E. D. Hinton, Manager, Ground Support Equipment Department, NA 3-1632. Or write for Brochure.



HAMILTON STANDARD
DIVISION OF
UNITED AIRCRAFT CORPORATION
WINDSOR LOCKS, CONNECTICUT



TAPCO OFFERS

The expanding Engineering Department of the TAPCO GROUP of Thompson Rams Woodbridge has offices and expert facilities for custom model designs and analyses. TAPCO's products, drawings, equipment and services for a wide range of defense needs from space to submarine projects, provides a new meaning to the phrase "job security."

Services offered now in the fields of:

- Aerothermodynamics
- Airframe Structural Analysis
- Bearings and Seals
- Electrical Phase Studies
- Electronic Circuit Design
- Electro-Mechanical Reliability
- High Temperature Phenomena
- Mechanical Stress Analysis
- Mechanical Testing
- Metallurgical Development
- Military Operations Research
- Power System Design/Analysis
- Standards and Specifications
- Thermodynamics
- Underwater Acoustics

TAPCO is located in quietest Cleveland suburb in gracious suburban setting and to assure fine values when affecting security study opportunities.

If you seek your engineering skills would be of interest to us, send a resume to:

Mr. J. J. Tuckley,
Recruitment Manager,
Box 604

TAPCO

THE TAPCO GROUP OF
Thompson Rams Woodbridge Inc.
10000 Euclid Avenue
Cleveland 12, Ohio

FINANCIAL

Financial Briefs

Control Data Corp. earnings for Dec. 1980 were \$751,636 on sales of \$9,665,390 compared with earnings of \$125,214 on sales of \$4,188,174 for the previous year.

Atlantic Research Corp. earnings for the six months ended June 30 were \$129,482 on sales of \$1,945,215. This compares with the previous year's first-half earnings of \$786,955 on sales of \$1,429,010.

Sigtek Corp. earnings for the year ended June 30 were \$2,501,821 on net consolidated sales of \$44,065,002, compared with earnings of \$2,283,832 on sales of \$37,814,443.

Amco-General Corp. reported earnings of \$6,737,367 for the nine-month period ending Aug. 31, an increase of 12% over the comparable period of 1979. Sales increased 20% to \$186,775,904. Earnings per share of common stock increased 15 cents to \$1.47.

Echostar Air Lines reported net profit for 1979 of \$286,784 compared with last year's net of \$74,797. Operating revenues for 1979 totaled \$6.1 million and operating expenses \$5.7 million compared with last year's figures of \$6.1 million and \$5.9 million respectively.

Dividend income of 25% by **Citrus Security Co.** increases annual payment to stockholders from 50 cents to \$1.30 per share, with the first dividend due at the highest rate of 25 cents being payable Nov. 17 to shareholders of record Nov. 1. That is the fourth dividend increase by Citrus in the past five years. Since June 1974, Citrus has raised the annual dividend figure indicated total value of more than \$200 million for the first year ended Sept. 18, down from last year's \$165,788,800, with the drop attributed to lower earnings, operational and in district subsidiaries losses. Current call price index revealed about \$36 million a 20% increase. With this, the first outlook for 1980 looks better than 1980 in volume and profits.

Venture capital investing now shows some quarterly paper profits in individual cases, although these might be offset by losses on others. American Research and Development, a Boston-based investment group, was in 11.67 shares of High Voltage Engineering Co. rose to sales from \$85,271 when purchased to \$4,644,816 at the end of the first half of 1980. High Voltage holds portfolio, acquisition and is active

work in the fields of the future of HVA.



PHYSICAL METALLURGISTS

Join our industry's most progressive branch in exploring the metallurgical frontiers of rapid anneal.

Here are unusual opportunities in applied research for experienced metallurgists who would like to manage research and development and expand their "sphere of influence."

Successful applicants must have the ability to organize and direct the work of others; have previous work experience in metallurgical research; and be active in an expanding materials development program.

Background and Preferred Graduate Metallurgical Degree near with at least four years experience including development or application work in one or more of the following applications:

- Titanium Alloys
- Hot Work Tool Steels
- Superalloys
- Refractory Metals
- Miscellaneous Metals
- Other Heat Treatable

For more information please write to: Mr. A. K. Bannan, Engineering Personnel, North American Aviation, Inc., Los Angeles 40, California.

THE LOS ANGELES OFFICE OF
NORTH AMERICAN AVIATION, INC.

in the electrostatic propulsion research field.

Problems with such profits, based on the over-the-counter stock market bid quotations for the shares, is that sale of such a large block of the stock might bring a price under this figure. Such stocks can be volatile as well. American Research bought 52,000 shares of Itek Corp., also a Boston company in the information retrieval field (AW Dec. 7, p. 109), for \$446,800 during the first half, and the value rose to \$775,800 at mid-year, then drop back to \$500,000 during the pre-election market decline.

United Air Lines has declared a quarterly dividend of 12 1/2 cents per common share as well as a 3% stock dividend, payable Dec. 15 to stockholders of record Nov. 15.

Westinghouse earnings for the nine months ended Sept. 30 were \$68,580,800 on sales of \$1,457,233,980 compared with earnings of \$56,225,006 on sales of \$1,068,391,000 for the first nine months of 1979.

New Offerings

Technical Measurement Corp., North Haven, Conn., which was organized pursuant to Delaware law on June 28, 1968, and on June 10 organized all the outstanding stock of a Connecticut corporation of the same name owned by R. M. Chen, president, and D. S. Davidson, I. Fleishman, and G. F. Hertz, officers, who secured all the outstanding 400,000 common and 1,350 preferred shares of the new corporation in exchange for their holdings of the predecessor company. The predecessor company, which was incorporated in 1964, was a company which was engaged in the manufacture and sale of electronic equipment, primarily analog/digital, digital computers. Operating in 1970, 1971, 1972, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 2680, 2681, 2682, 2683, 2684, 2685, 2686, 2687, 2688, 2689, 2690, 2691, 2692, 2693, 2694, 2695, 2696, 2697, 2698, 2699, 2700, 2701, 2702, 2703, 2704, 2705, 2706, 2707, 2708, 2709, 2710, 2711, 2712, 2713, 2714, 2715, 2716, 2717, 2718, 2719, 2720, 2721, 2722, 2723, 2724, 2725, 2726, 2727, 2728, 2729, 2730, 2731, 2732, 2733, 2734, 2735, 2736, 2737, 2738, 2739, 2740, 2741, 2742, 2743, 2744, 2745, 2746, 2747, 2748, 2749, 2750, 2751, 2752, 2753, 2754, 2755, 2756, 2757, 2758, 2759, 2760, 2761, 2762, 2763, 2764, 2765, 2766, 2767, 2768, 2769, 2770, 2771, 2772, 2773, 2774, 2775, 2776, 2777, 2778, 2779, 2780, 2781, 2782, 2783, 2784, 2785, 2786, 2787, 2788, 2789, 2790, 2791, 2792, 2793, 2794, 2795, 2796, 2797, 2798, 2799, 2800, 2801, 2802, 2803, 2804, 2805, 2806, 2807, 2808, 2809, 2810, 2811, 2812, 2813, 2814, 2815, 2816, 2817, 2818, 2819, 2820, 2821, 2822, 2823, 2824, 2825, 2826, 2827, 2828, 2829, 2830, 2831, 2832, 2833, 2834, 2835, 2836, 2837, 2838, 2839, 2840, 2841, 2842, 2843, 2844, 2845, 2846, 2847, 2848, 2849, 2850, 2851, 2852, 2853, 2854, 2855, 2856, 2857, 2858, 2859, 2860, 2861, 2862, 2863, 2864, 2865, 2866, 2867, 2868, 2869, 2870, 2871, 2872, 2873, 2874, 2875, 2876, 2877, 2878, 2879, 2880, 2881, 2882, 2883, 2884, 2885, 2886, 2887, 2888, 2889, 2890, 2891, 2892, 2893, 2894, 2895, 2896, 2897, 2898, 2899, 2900, 2901, 2902, 2903, 2904, 2905, 2906, 2907, 2908, 2909, 2910, 2911, 2912, 2913, 2914, 2915, 2916, 2917, 2918, 2919, 2920, 2921, 2922, 2923, 2924, 2925, 2926, 2927, 2928, 2929, 2930, 2931, 2932, 2933, 2934, 2935, 2936, 2937, 2938, 2939, 2940, 2941, 2942, 2943, 2944, 2945, 2946, 2947, 2948, 2949, 2950, 2951, 2952, 2953, 2954, 2955, 2956, 2957, 2958, 2959, 2960, 2961, 2962, 2963, 2964, 2965, 2966, 2967, 2968, 2969, 2970, 2971, 2972, 2973, 2974, 2975, 2976, 2977, 2978, 2979, 2980, 2981, 2982, 2983, 2984, 2985, 2986, 2987, 2988, 2989, 2990, 2991, 2992, 2993, 2994, 2995, 2996, 2997, 2998, 2999, 3000, 3001, 3002, 3003, 3004, 3005, 3006, 3007, 3008, 3009, 3010, 3011, 3012, 3013, 3014, 3015, 3016, 3017, 3018, 3019, 3020, 3021, 3022, 3023, 3024, 3025, 3026, 3027, 3028, 3029, 3030, 3031, 3032, 3033, 3034, 3035, 3036, 3037, 3038, 3039, 3040, 3041, 3042, 3043, 3044, 3045, 3046, 3047, 3048, 3049, 3050, 3051, 3052, 3053, 3054, 3055, 3056, 3057, 3058, 3059, 3060, 3061, 3062, 3063, 3064, 3065, 3066, 3067, 3068, 3069, 3070, 3071, 3072, 3073, 3074, 3075, 3076, 3077, 3078, 3079, 3080, 3081, 3082, 3083, 3084, 3085, 3086, 3087, 3088, 3089, 3090, 3091, 3092, 3093, 3094, 3095, 3096, 3097, 3098, 3099, 3100, 3101, 3102, 3103, 3104, 3105, 3106, 3107, 3108, 3109, 3110, 3111, 3112, 3113, 3114, 3115, 3116, 3117, 3118, 3119, 3120, 3121, 3122, 3123, 3124, 3125, 3126, 3127, 3128, 3129, 3130, 3131, 3132, 3133, 3134, 3135, 3136, 3137, 3138, 3139, 3140, 3141, 3142, 3143, 3144, 3145, 3146, 3147, 3148, 3149, 3150, 3151, 3152, 3153, 3154, 3155, 3156, 3157, 3158, 3159, 3160, 3161, 3162, 3163, 3164, 3165, 3166, 3167, 3168, 3169, 3170, 3171, 3172, 3173, 3174, 3175, 3176, 3177, 3178, 3179, 3180, 3181, 3182, 3183, 3184, 3185, 3186, 3187, 3188, 3189, 3190, 3191, 3192, 3193, 3194, 3195, 3196, 3197, 3198, 3199, 3200, 3201, 3202, 3203, 3204, 3205, 3206, 3207, 3208, 3209, 3210, 3211, 3212, 3213, 3214, 3215, 3216, 3217, 3218, 3219, 3220, 3221, 3222, 3223, 3224, 3225, 3226, 3227, 3228, 3229, 3230, 3231, 3232, 3233, 3234, 3235, 3236, 3237, 3238, 3239, 3240, 3241, 3242, 3243, 3244, 3245, 3246, 3247, 3248, 3249, 3250, 3251, 3252, 3253, 3254, 3255, 3256, 3257, 3258, 3259, 3260, 3261, 3262, 3263, 3264, 3265, 3266, 3267, 3268, 3269, 3270, 3271, 3272, 3273, 3274, 3275, 3276, 3277, 3278, 3279, 3280, 3281, 3282, 3283, 3284, 3285, 3286, 3287, 3288, 3289, 3290, 3291, 3292, 3293, 3294, 3295, 3296, 3297, 3298, 3299, 3300, 3301, 3302, 3303, 3304, 3305, 3306, 3307, 3308, 3309, 3310, 3311, 3312, 3313, 3314, 3315, 3316, 3317, 3318, 3319, 3320, 3321, 3322, 3323, 3324, 3325, 3326, 3327, 3328, 3329, 3330, 3331, 3332, 3333, 3334, 3335, 3336, 3337, 3338, 3339, 3340, 3341, 3342, 3343, 3344, 3345, 3346, 3347, 3348, 3349, 3350, 3351, 3352, 3353, 3354, 3355, 3356, 3357, 3358, 3359, 3360, 3361, 3362, 3363, 3364, 3365, 3366, 3367, 3368, 3369, 3370, 3371, 3372, 3373, 3374, 3375, 3376, 3377, 3378, 3379, 3380, 3381, 3382, 3383, 3384, 3385, 3386, 3387, 3388, 3389, 3390, 3391, 3392, 3393, 3394, 3395, 3396, 3397, 3398, 3399, 3400, 3401, 3402, 3403, 3404, 3405, 3406, 3407, 3408, 3409, 3410, 3411, 3412, 3413, 3414, 3415, 3416, 3417, 3418, 3419, 3420, 3421, 3422, 3423, 3424, 3425, 3426, 3427, 3428, 3429, 3430, 3431, 3432, 3433, 3434, 3435, 3436, 3437, 3438, 3439, 3440, 3441, 3442, 3443, 3444, 3445, 3446, 3447, 3448, 3449, 3450, 3451, 3452, 3453, 3454, 3455, 3456, 3457, 3458, 3459, 3460, 3461, 3462, 3463, 3464, 3465, 3466, 3467, 3468, 3469, 3470, 3471, 3472, 3473, 3474, 3475, 3476, 3477, 3478, 3479, 3480, 3481, 3482, 3483, 3484, 3485, 3486, 3487, 3488, 3489, 3490, 3491, 3492, 3493, 3494, 3495, 3496, 3497, 3498, 3499, 3500, 3501, 3502, 3503, 3504, 3505, 3506, 3507, 3508, 3509, 3510, 3511, 3512, 3513, 3514, 3515, 3516, 3517, 3518, 3519, 3520, 3521, 3522,

SIXTH ANNUAL
Aviation Week

BUYERS' GUIDE ISSUE

THE ONLY COMPLETE BUYERS' GUIDE SERVING
THE ENTIRE AEROSPACE INDUSTRY

THE STANDARD PURCHASING REFERENCE
OF THE AEROSPACE MARKET

MAJOR PRODUCT CATEGORIES INCLUDE
AIRCRAFT • AVIONICS
SPACE VEHICLES & MISSILES
SUPPORT EQUIPMENT & ACTIVITIES
AIRPORT & AIRLINE EQUIPMENT

AVIATION WEEK's Annual Buyers' Guide is one source for buying information in all segments of the dynamic aerospace industry. It's on the engineer's desk...at his fingertips...readily accessible...with needed information.

The new 1961, 6th Annual Edition, now in preparation, is more complete and essential than ever before, containing expanded listings on new products and companies in new areas of the total market.

It will contain over 50,000 manufacturers' product listings in 1,800 product categories. In addition to being quick and easy to use, the BUYERS' GUIDE includes complete listings of government procurement agencies telling: Where to go; Who to see; What they buy.

BUYERS' GUIDE usage was demonstrated in a survey conducted eight months after publication of the 1958 edition.

71% of respondents still had their copy
60% of this group referred to it at least once a month.

This means your advertising is available to the purchaser or spender at the moment buying information is needed. Its constant reference value and year-long life offers multiple exposure of your advertising.

Advertisers' product listings are bold faced and include a reference to the page number of their advertising. In addition to an alphabetical advertisers' index, there is a "product" advertisers' index. To supply you with key industry sales leads the BUYERS' GUIDE contains Reader Service cards.

If you sell to the aerospace industry, your advertising message belongs in the BUYERS' GUIDE—as well as your company's product listings.

PUBLISHING DATE: Mid-December

CLOSING DATE: November 15, 1960

ABC FIVE CIRCULATION 75,765

A McGraw-Hill Publication
330 West 42nd Street, New York 36, N. Y.

Aviation Week
and **Space Technology**

ADVANCE PROGRAMS at the DENVER DIVISION OF THE MARTIN COMPANY

Recognition of the need for the comparative professional contributions which may be made in order to secure and build new business has resulted in the formation of a new division at Martin Denver. It is this:

ADVANCE PROGRAMS DIVISION

whose director reports directly to the Vice President. Positions are open in the areas of 15 years experience in the following departments:

RESEARCH—Applied study, jet dynamics, jet engine propulsion, space mechanics, physics, fluid flow, etc. • BS required. PhD preferred with 3 years experience in research.

OPERATIONS RESEARCH—Mathematical model building, simulation, optimization and forecasting studies, etc. • BS or BA in Mathematics or Physics, superior MS preferred. Min 3 years experience.

ADVANCE DESIGN—Analysis and design at a top production level for large landers, JCRs, space vehicles, satellites, etc. • BS required plus 5 years experience in advance design work for missile and rocket programs.

ADVANCE BUSINESS PLANNING—Assessment of potential new business ideas to be aligned to Company resources and long range corporate planning. • BA or BS plus 5-10 years experience in long range planning at defense type business.

The writing and publishing of professional papers are encouraged by top management of this Division.

Several of the openings in the above departments are for experienced Supervisory candidates and these good technical backgrounds as well as administrative talents.

For a full, thorough evaluation of your professional opportunities in the ADVANCE PROGRAMS DIVISION, please visit our group directly at location, experience, list of publications and salary desired to:

DAVID POTTER

Manager—Creative and Scientific Recruitment
Mail RM-66 • The Martin Company • P.O. Box 125, Denver 1, Colorado

MARTIN

DENVER DIVISION

YOUR INQUIRY WILL RECEIVE AN ANSWER WITHIN 10 DAYS

offering price and underwriting terms to be supplied by underwriter. The additional 127,000 common shares represent part of the consideration being paid by the company for all the outstanding common stock of Pioneer Electric, Ltd. (a Canadian company) from its sole common stockholders. Proceeds of the sale of the 127,000 common shares will be applied toward supplying the cash consideration for the purchase of the Pioneer stock, the balance to retire short term bank loans and for working capital.

Gulton Industries, Inc., Metuchen, N. J., engaged in the research, development and manufacture of electronic, electro-mechanical and electro-acoustic components, instruments and equipment which are sold to the military and to commercial manufacturers. Offering is 100,000 shares of common stock, for public sale, offering price and underwriting terms to be supplied by underwriter. Proceeds will be added to the company's present funds and an large part of which will be retained as short term government securities. Thereafter, funds will be available as additional working capital for the carrying of operations and accounts receivable. In addition, the company intends to apply a substantial portion of such proceeds to the acquisition of related and complementary businesses. The company recently acquired a 67% interest in Gulton Research Corp. Inc., Alhambra, N. Y., and has contracted to purchase the remaining 33% interest, the total purchase price being \$18,800 plus payments over the next three years in company stock.

Lithium Corporation of America, Inc., New York, N. Y., principal business, the production and sale of lithium metal and lithium compounds, principally sales and research efforts, the development of new markets and new uses for such products. Recently the company has extended its business into various phases of industry and commerce. Offering is \$2,100,000 of convertible subordinated debentures, due 1978, for public sale; interest rate, offering price and underwriting terms to be supplied by underwriter. First, however, the new debentures will be offered in exchange for \$925,000 of outstanding 5% convertible debentures maturing in 1968. Proceeds remaining after disposition of the debentures due 1968 will be used as follows: \$75,000 for construction of facilities to be used in production of beryllium and other organolithium compounds, \$175,000 for purchase of mining equipment to reconstruct the company's North Carolina mining operations, the balance for liquidation of bank debt and replacement of working capital.

RELIABILITY



Heavy and Air Force B-57 Canberra has been called by the Navy "the world's most reliable guided missile." It is so fast and it can be loaded on an ordinary road of construction.

MARTIN

SAFETY

CAB Accident Investigation Reports:

Fuel Starvation Causes C-54 to Crash

[illegible]

The second was caused by fuel exhaust (see data in the unnumbered paragraph prior to table) of the fuel rail selector in the main engine air-start tanks. Due to the time or time interval that passed between No. 1 and No. 2, the crew made No. 1 shut No. 2, the crew made an effort to reposition the fuel selector to the full main position.

Investigation

N 4805A was engaged in a "Quadrant scheduled U S Navy contract cargo flight which originated in Oakland, Calif., the previous day. Captain Jewell Reed and Co-pilot Carles Calk, were scheduled to make the flight from Indianapolis to McAle Cherry Field, N. C. with a stop at Charlotte, S. C.

N 406A, flown to a different area, arrived at Jacksonville, NAS from Dallas at 1700. The two new crew members used for duty at 1800. The captain, implanted the meters from 1.5 flight miles and the weight and balance record. The captain was briefed on the weather and conducted the seventh nightlight check. The seventh was being conducted at the time of the nightlight check. Approximately 30 min later the captain donned the fuel tank, swung onto the ramp and observed

case, balance be used. The gross weight at takeoff was 66 700 lb., 7 299 lb. under the allowable maximum gross weight.

The W. Light phase was first to Jacksonville via Vero Beach 1 in latter afternoon and Vero Beach 104 to Charleston with Norfolk Vt. as the alternate airport. Jacksonville weather deteriorated with broken clouds at 2,000 ft. 10,000 ft. occurred within three mi. in fog and smoke.

The daylight engine start engine rump and the island at 20° on engine 990 were normal. The Jacksonville engine start engine rump cleared the light tower Jacksonville Vero 1 in 10 min. 10,000 ft. minimum 1,000 ft. (clouds on landing at 1,000 ft. and further normal).

The crew stated that following takeoff the gas turbine power reduction, flap retraction and take clearances were normal. Upon reaching approximately 1400 ft altitude the No 4 engine surge. No 4 thrust was reduced and upon selected fuel surge command and the surgebleed pressure fell off. A check of the instrument panel revealed that all instruments were normal except the No 4 fuel pressure and fuel flow which fluctuated. No fuel warning light was observed. The use of inhibitor tank and selection of the low and high fuel booster pumps did not correct the condition.

At 1100 N 9000A advised the FIAA Inshore Airport departure cleared at Jack, and while it was having trouble with two 4 engine and acquired provisions to reach the 1000 ft. The aircraft was reported at 1500 N. This was reported. At 2150, N 9000A reported a radio contact took place in Jacksonville Naval Air Station. The pilot was instructed to turn to a heading of 75° deg. Subsequently the following was received: "We are 4000 ft. above the water. We have 1000 ft. of fuel. We are going to New Jacksonville (the Jacksonville region) 1500 ft. and is the proper. Monitor the clearance not the radio but we are acknowledged in the pilot. N 2305 the radio ship of N 9000A disappeared below the horizontal capabilities of the Inshore Airport. Reported cleared at 0200.

Following loss of No. 4 engine, the pilot initiated a left turn towards the 2-3-day heading suggested by departure control. During the turn the No. 4 exhaust heat temperature decreased; the fuel flow was then closed, and the engine had just decided to feather the propeller when the No. 3 engine began to vibrate. Feathering of No. 3 propeller was delayed and the engine called for MTO power instead. This power could not be obtained as No. 3 engine continued to vibrate; to prevent this, two seconds later No. 2 engine began to vibrate. During the emergency the

captain stated, "I think we must have taken on jet fuel." It sets me a C-45 dot when they were given jet fuel." During the base the captain searched away and checked the position of the fuel selectors but the captain does not remember whether they were moved from their position.

The flight crew did not notice the engine instrument readings after the No. 4 engine difficulty nor did they realize whether there was a loss of power from No. 1 engine.

The aircraft was descending rapidly and an attempt was made to ditch on a small lake located ahead. Several tons were struck in the attempt and the aircraft hit the water 500 ft level and in a violent attitude on a heading of 15 deg.

magnetic heading in 30 ft of water approximately 300 ft from the lake western shore and 150 ft from its northern shore, with approximately 50% of the barge submerged. The crewman the upper barge down to the top window line by lower barge struts 125 to 141.

Weakness Exposed

Sections and small pieces of the left and right wings enclosing the altars, and pieces of the left and right stubs were found strewn along the approach path. All four squared propellers were in the shallow water near the ship's bow.

port and to the right of the approach path, midstroke.

Two members of the aircraft pair to recover the wreckage revealed that the fuel tank address valves were in an undetected fuel position. Formation of the aircraft was not maintained, and the aircraft had wings level on touchdown in the fuel line in the four engines. The aircraft were not equipped with fuel tank address valves, and the fuel tank address valves were not installed. There was no evidence of mechanical malfunction failure in fueling any part of the aircraft prior to impact and no evidence of fueling system failure to impact. A check of the aircraft records revealed that there were between 25.00 gal of fuel in each of the fuel mainline tanks at the time of the accident. The aircraft had been fuelled at the base, and the fueling operation of the aircraft was performed by a member of the aircraft crew. The aircraft had been fuelled at the base, and the fueling operation of the aircraft was performed by a member of the aircraft crew. The aircraft had been fuelled at the base, and the fueling operation of the aircraft was performed by a member of the aircraft crew.

U.S. Aircraft	Altitude	Max. Fuel	Test the Following Fuel
* C-14B DC	aircraft	18 Fuel	Test System
* C-14B DC	aircraft	15 Fuel	Test System

```
1 C 54 C: result: (M 4000A) C:
   Fuel Tank System]
2 DC-6A: aircraft
3 DC-6B: aircraft
```

GI) all these Douglas controls has some what similar fuel systems. Among the differences between the G-54-E and the E and G are the number of fuel tanks installed and the tank selector handle positions. The fuel selector positions for the G-54-E are REAR-OFF, FORWARD-MAIN TANKS. The fuel selector valve positions for the G-54-E tank system are REAR-OFF, CENTER-MAIN TANKS, FORWARD-MAIN TANKS.

The checklist in the survey was one of the return type and was based on a questionnaire indicating that it had been used and the following items: PROPLAC-101, ENTERTAINMENT AIRCRAFT, FAST AIRCRAFT, START ENGINE, and PRETAXI. The primary and secondary checklist items relating to fuel tank status or status are as follows:

PRESTRESS—MAIN TANKS (Type System)—4DN
PRETAKOFF—MAIN TANKS (New Type System)—4DN

In addition, the following placards are found on the instrument panel above the fuel selector:

- "CAUTION—Before takeoff, check operation of each engine on all eight main and auxiliary tanks."
- "Takeoff on main tanks, cross to auxiliary tanks, then back to main tanks for landing."

others that fuel will be used

No differences were found in the appearance or flight patterns regarding the different configurations of G-14 fuel systems and fuel collector nozzles.

1970-1971 season. Between 1970 and 1971, the population of the Cape Roost increased by 150 to 2,500, of which over 100 were in the light roosts of Cape Roost. Subsequent data were not available until 1975. In 1975, the population of the Cape Roost was 2,450. In 1976, between 21, 1976, he had completed 240 flights in the C-14B and 130 flights in the C-14C. Between 1976 and 1977, he completed 240 flights in the C-14B and 130 flights in the C-14C. The first person to fly over the Cape Roost was in 1976.

The second weather at the time of the accident was broken clouds at 1,900 ft, 16,800 ft overcast, visibility three to five km and smoke. However, according to verbal statements of the captain, the actual weather was scattered clouds with visibility unlimited and the moon fully visible. A U.S. Navy aircraft carrying the wreckage shortly after the accident reported weather conditions at broken clouds at an estimated 3,000 ft and visibility 10 km.

An analysis of all refinery indicators that the accident resulted from fuel exhaustion due to postponing the fuel tank selection to virtually empty tanks prior to takeoff. The 21.90 gal of fuel in each



The Cape Canaveral test record of Martin's Titan IIIM is, according to the Air Force, "the best success rate to date" in USAF missile programs.

work. "I risked my life, sufficient to take off and crash the rocket and not the No. 1 fuel tank contained slightly more fuel than the others. It is also obvious that the regulator did not work, the fuel system during the emergency as indicated possible in the engine but materials can indicate himself to be a 6.6 fuel tank, an out and believed therefore that the fuel tank fuel release pressure was constant for the same fuel tanks and much made sure that they were contained in the forward section of the tank.

The fault was suggested as a contaminated fuel tank that was a homogeneous explosion and completely dissipated in the rocket laboratory and/or fuel sample, and degradation of an fuel tank handling and dispensing. The same fuel tanks were filled to a total of 950 gal. But the other engine fuel tanks were not. Only 2750 gal of fuel remained in each of them. Fuel is indicated in the gaps where located in the piston light ray.

While it is not unreasonable for the engine to have rendered the possibility of engine fuel as a reason for the loss of power, the Board believes it should not have been accepted to the exclusion of fuel injection. Examination of fuel pressure and fuel flow should have alerted the engine to the visual difficulty, particularly in view of the engine of the engine and the fact that the fuel pump pump did not operate the rocket and the fact that the rocket had been previously checked for the possibility of the presence of fuel. Searching fuel solenoid

was in position tank should normally be one of the first steps of a pilot and fuel solenoid solenoid of fuel pressure and fuel flow.

In addition, Capt. Reed had time to meet moments to analyze his problem before impact.

Probable Cause

The Board determines that the probable cause of the accident was aircraft fuel system management resulting in a power loss in three engines.

In the Civil Aeronautics Board

Barbara Greenham
Chairman
Cecil Conway
Vice Chairman
G. Joseph Martin
Member
Alan S. Bore
Member
J. S. Bowers
Member

The Civil Aeronautics Board was notified of the rocket launch after it occurred. An investigation was immediately initiated in connection with the presence of John VII of the Federal Aviation Act of 1958.

United States District Attorney for Idaho v. Congress C-941 residents of public contractors and contractors in space v. a domestic corporation, the Congress which requires May 30, 1961 and FAA Air Carrier Operating Certificate No. N11 authorizing flights on three passengers and cargo operations. The contract was

equal spending and maintenance has a liability in California. "Managed" report Oakland, Calif.

Capt. David Reed, age 41, was employed by U. S. Greenham Airlines on July 22, 1990, as a captain on C-141 aircraft flying low altitude from the U. S. West coast to a mid-western airport. He had a total of 10,000 flight hours, 7,000 of which were in C-141 aircraft. He had been a total of 200 in the last 90 days of all of which was in C-141 aircraft. He had completed the required ground school, instrument and proficiency checks.

Captain Gordon Cole, age 41, was employed by U. S. Greenham Airlines on July 22, 1990. He had a total of 10,000 flight hours, 7,000 of which were in C-141 aircraft. He had been a total of 200 in the last 90 days of all of which was in C-141 aircraft. He had completed the required ground school, instrument and proficiency checks.

Douglas C-141 C-400A would have been used in the U. S. West coast. The aircraft was purchased by U. S. West on Nov. 16, 1975, and was of a type configuration. It had a total flight time of 10,000 hours. It had a total of 10,000 hours. No. 1 and 4 engines were

Port & Whitney R-2800 D-5 from Wings No. 1 and 3 engines were Port & Whitney R-2800 TMD from Wings. No. 1 engine had 17,540 total hours, 6,911 hours since overhaul. No. 2 engine had 6,911 total hours, 961 hours since overhaul. No. 3 engine had 17,650 total hours, 799 hours since overhaul. No. 4 engine had 18,754 total hours, 317 hours since overhaul.

Turbulence May Have Caused B-26 to Crash

Washington—Providence, that severe turbulence played a major role in the crash of a Continental Airlines B-26C on Feb. 1, 1990, near Mexico, Calif., was stated in a report. Civil Aeronautics Board released report.

Board investigators were unable to determine the probable cause of the accident because of the nearly complete destruction of the wreckage, but the report indicated the aircraft apparently went out of control while flying through an active line of developing thunderstorms.

John B. Conner and John B. Conner, who were on the flight, were the aircraft crash on route from Chicago, Ill., to Baltimore, Md., with eight passengers on board, when it was seen to enter a steep vertical descent from an altitude of 4,000 ft. and crash at a point about three miles from Mexico and 15 mi

from the flight's planned course. Speed of impact was "extremely high," CAB said, with heavier portions of the aircraft found embedded nearly eight feet in hard earth. Crew and passengers all were killed.

The Board found no evidence of structural failure or powerplant failure in flight, but it indicated the aircraft may have sustained structural damage which could have caused the dive, as a result of flying through severe turbulence, a few minutes before.

While the aircraft's course deviation may have been a pilot's attempt to avoid the worst of the weather as indicated by instrument radar, CAB concludes that this was not a probable cause. The aircraft descended from its assigned 9,000-ft. altitude to only 4,000 ft. over Mexico. In addition, the aircraft lost its two pilots' competence in flying of high quality, with records showing that Dardano had total flying time of 10,577 hr., with 885 on the B-26, and Martin had 3,766 by both 1,718 on the two-engine aircraft.

During that time, several "flight" member diversions were a mild, but not reported by the flight, CAB said it has been conducting with other government agencies and industry to insure that all flights which might encounter severe weather receive the severe weather briefing.



PanAm Skyscraper

The \$100 million, 11-story skyscraper now under construction in southern Manhattan and showing General Contract Terminal will have the same of Pan American World Airways. The office has been 645,000 sq ft of space in the PanAm Building. The new quarters will house executive offices, public and sales, executive engineering, maintenance, technical training, and research of supply. Development is reported in 1963.

POLARIS ON PATROL

LOCKHEED

MISSILES & SPACE DIVISION, SUNNYVALE, CALIFORNIA

WHO'S WHERE

(Continued from page 24)

Honors and Elections

Robert Nelson, manager of Product Support Publications at General Electric's Langley Engine Department, has been elected national chairman of Aerospace Industries Association's Publications Committee.

W. B. Runkel, vice president of General Electric's La Grange, has been elected chairman of the Motion Picture Industry Conference of the national section for the International Air Transport Association.

John L. Rucklows, senior vice president of United Technology Corp., has been elected president of the American Society for the Defense of the Sciences, succeeding Eric L. Rens, Jr., who has shifted chairman of the board. Other new officers named E. Helges of General Dynamics Equipment Co. has been president; John J. Adams of General Motors Corp. second vice president; George D. Whelan, Jr. of General Electric of General Dynamics Corp. secretary; Joseph P. Delaney, of Bell Telephone Laboratories, Inc. treasurer; and Thomas J. Quinn of Stanford Research Institute and Timothee J. Walsh, of Sperry Gyroscope Co., elected 1st vice president.

Changes

Capt. James B. Denton (USN) will direct product planning and development for the Navy's new aircraft carrier, the USS Zumwalt (CVN-60). He will be based at the Naval Air Station, Naval Air Station, New York City.

Robert C. Runkel, director of the research and development division of the General Dynamics Corp., has been elected president of the company.

Dr. Robert C. Runkel, director of the research and development division of the General Dynamics Corp., has been elected president of the company.

Dr. Robert C. Runkel, director of the research and development division of the General Dynamics Corp., has been elected president of the company.

Dr. Robert C. Runkel, director of the research and development division of the General Dynamics Corp., has been elected president of the company.

Dr. Robert C. Runkel, director of the research and development division of the General Dynamics Corp., has been elected president of the company.

Dr. Robert C. Runkel, director of the research and development division of the General Dynamics Corp., has been elected president of the company.

Dr. Robert C. Runkel, director of the research and development division of the General Dynamics Corp., has been elected president of the company.

Dr. Robert C. Runkel, director of the research and development division of the General Dynamics Corp., has been elected president of the company.

SEARCHLIGHT SECTION

CLASSIFIED BUSINESS OPPORTUNITIES

EQUIPMENT - USED or REPAIR

UNPUBLISHED INFO:

The advertising rate is \$2.00 per line for all advertising appearing in this section on a regular basis. Contact your local newspaper for a complete list of rates. All advertising is subject to space availability. Payment in advance is required. All advertising is subject to space availability. Payment in advance is required.

UNPUBLISHED INFO:

The advertising rate is \$2.00 per line for all advertising appearing in this section on a regular basis. Contact your local newspaper for a complete list of rates. All advertising is subject to space availability. Payment in advance is required.

For more information on this or other classified advertising, contact the publisher of this publication.

LEASE OR LEASE PURCHASE

14



LOCKHEED CONSTELLATIONS MODEL 749A FORMERLY OPERATED BY EASTERN AIR LINES

Ready for immediate service and delivery at Miami, Florida, powered with WRIGHT SPEED ENGINES and equipped with HAMILTON STANDARD PROPELLERS. Each aircraft can be delivered ZERO TIME in the airframe since last block overhaul and has about 900 hours on each engine since major. All aircraft are equipped with latest type full service engine and maintain an extraordinary 1,400 mph. (400 mph) capacity 5,500 ft. 8,000 ft. 10,000 ft. 12,000 ft. 14,000 ft. 16,000 ft. 18,000 ft. 20,000 ft. 22,000 ft. 24,000 ft. 26,000 ft. 28,000 ft. 30,000 ft. 32,000 ft. 34,000 ft. 36,000 ft. 38,000 ft. 40,000 ft. 42,000 ft. 44,000 ft. 46,000 ft. 48,000 ft. 50,000 ft. 52,000 ft. 54,000 ft. 56,000 ft. 58,000 ft. 60,000 ft. 62,000 ft. 64,000 ft. 66,000 ft. 68,000 ft. 70,000 ft. 72,000 ft. 74,000 ft. 76,000 ft. 78,000 ft. 80,000 ft. 82,000 ft. 84,000 ft. 86,000 ft. 88,000 ft. 90,000 ft. 92,000 ft. 94,000 ft. 96,000 ft. 98,000 ft. 100,000 ft. 102,000 ft. 104,000 ft. 106,000 ft. 108,000 ft. 110,000 ft. 112,000 ft. 114,000 ft. 116,000 ft. 118,000 ft. 120,000 ft. 122,000 ft. 124,000 ft. 126,000 ft. 128,000 ft. 130,000 ft. 132,000 ft. 134,000 ft. 136,000 ft. 138,000 ft. 140,000 ft. 142,000 ft. 144,000 ft. 146,000 ft. 148,000 ft. 150,000 ft. 152,000 ft. 154,000 ft. 156,000 ft. 158,000 ft. 160,000 ft. 162,000 ft. 164,000 ft. 166,000 ft. 168,000 ft. 170,000 ft. 172,000 ft. 174,000 ft. 176,000 ft. 178,000 ft. 180,000 ft. 182,000 ft. 184,000 ft. 186,000 ft. 188,000 ft. 190,000 ft. 192,000 ft. 194,000 ft. 196,000 ft. 198,000 ft. 200,000 ft. 202,000 ft. 204,000 ft. 206,000 ft. 208,000 ft. 210,000 ft. 212,000 ft. 214,000 ft. 216,000 ft. 218,000 ft. 220,000 ft. 222,000 ft. 224,000 ft. 226,000 ft. 228,000 ft. 230,000 ft. 232,000 ft. 234,000 ft. 236,000 ft. 238,000 ft. 240,000 ft. 242,000 ft. 244,000 ft. 246,000 ft. 248,000 ft. 250,000 ft. 252,000 ft. 254,000 ft. 256,000 ft. 258,000 ft. 260,000 ft. 262,000 ft. 264,000 ft. 266,000 ft. 268,000 ft. 270,000 ft. 272,000 ft. 274,000 ft. 276,000 ft. 278,000 ft. 280,000 ft. 282,000 ft. 284,000 ft. 286,000 ft. 288,000 ft. 290,000 ft. 292,000 ft. 294,000 ft. 296,000 ft. 298,000 ft. 300,000 ft. 302,000 ft. 304,000 ft. 306,000 ft. 308,000 ft. 310,000 ft. 312,000 ft. 314,000 ft. 316,000 ft. 318,000 ft. 320,000 ft. 322,000 ft. 324,000 ft. 326,000 ft. 328,000 ft. 330,000 ft. 332,000 ft. 334,000 ft. 336,000 ft. 338,000 ft. 340,000 ft. 342,000 ft. 344,000 ft. 346,000 ft. 348,000 ft. 350,000 ft. 352,000 ft. 354,000 ft. 356,000 ft. 358,000 ft. 360,000 ft. 362,000 ft. 364,000 ft. 366,000 ft. 368,000 ft. 370,000 ft. 372,000 ft. 374,000 ft. 376,000 ft. 378,000 ft. 380,000 ft. 382,000 ft. 384,000 ft. 386,000 ft. 388,000 ft. 390,000 ft. 392,000 ft. 394,000 ft. 396,000 ft. 398,000 ft. 400,000 ft. 402,000 ft. 404,000 ft. 406,000 ft. 408,000 ft. 410,000 ft. 412,000 ft. 414,000 ft. 416,000 ft. 418,000 ft. 420,000 ft. 422,000 ft. 424,000 ft. 426,000 ft. 428,000 ft. 430,000 ft. 432,000 ft. 434,000 ft. 436,000 ft. 438,000 ft. 440,000 ft. 442,000 ft. 444,000 ft. 446,000 ft. 448,000 ft. 450,000 ft. 452,000 ft. 454,000 ft. 456,000 ft. 458,000 ft. 460,000 ft. 462,000 ft. 464,000 ft. 466,000 ft. 468,000 ft. 470,000 ft. 472,000 ft. 474,000 ft. 476,000 ft. 478,000 ft. 480,000 ft. 482,000 ft. 484,000 ft. 486,000 ft. 488,000 ft. 490,000 ft. 492,000 ft. 494,000 ft. 496,000 ft. 498,000 ft. 500,000 ft. 502,000 ft. 504,000 ft. 506,000 ft. 508,000 ft. 510,000 ft. 512,000 ft. 514,000 ft. 516,000 ft. 518,000 ft. 520,000 ft. 522,000 ft. 524,000 ft. 526,000 ft. 528,000 ft. 530,000 ft. 532,000 ft. 534,000 ft. 536,000 ft. 538,000 ft. 540,000 ft. 542,000 ft. 544,000 ft. 546,000 ft. 548,000 ft. 550,000 ft. 552,000 ft. 554,000 ft. 556,000 ft. 558,000 ft. 560,000 ft. 562,000 ft. 564,000 ft. 566,000 ft. 568,000 ft. 570,000 ft. 572,000 ft. 574,000 ft. 576,000 ft. 578,000 ft. 580,000 ft. 582,000 ft. 584,000 ft. 586,000 ft. 588,000 ft. 590,000 ft. 592,000 ft. 594,000 ft. 596,000 ft. 598,000 ft. 600,000 ft. 602,000 ft. 604,000 ft. 606,000 ft. 608,000 ft. 610,000 ft. 612,000 ft. 614,000 ft. 616,000 ft. 618,000 ft. 620,000 ft. 622,000 ft. 624,000 ft. 626,000 ft. 628,000 ft. 630,000 ft. 632,000 ft. 634,000 ft. 636,000 ft. 638,000 ft. 640,000 ft. 642,000 ft. 644,000 ft. 646,000 ft. 648,000 ft. 650,000 ft. 652,000 ft. 654,000 ft. 656,000 ft. 658,000 ft. 660,000 ft. 662,000 ft. 664,000 ft. 666,000 ft. 668,000 ft. 670,000 ft. 672,000 ft. 674,000 ft. 676,000 ft. 678,000 ft. 680,000 ft. 682,000 ft. 684,000 ft. 686,000 ft. 688,000 ft. 690,000 ft. 692,000 ft. 694,000 ft. 696,000 ft. 698,000 ft. 700,000 ft. 702,000 ft. 704,000 ft. 706,000 ft. 708,000 ft. 710,000 ft. 712,000 ft. 714,000 ft. 716,000 ft. 718,000 ft. 720,000 ft. 722,000 ft. 724,000 ft. 726,000 ft. 728,000 ft. 730,000 ft. 732,000 ft. 734,000 ft. 736,000 ft. 738,000 ft. 740,000 ft. 742,000 ft. 744,000 ft. 746,000 ft. 748,000 ft. 750,000 ft. 752,000 ft. 754,000 ft. 756,000 ft. 758,000 ft. 760,000 ft. 762,000 ft. 764,000 ft. 766,000 ft. 768,000 ft. 770,000 ft. 772,000 ft. 774,000 ft. 776,000 ft. 778,000 ft. 780,000 ft. 782,000 ft. 784,000 ft. 786,000 ft. 788,000 ft. 790,000 ft. 792,000 ft. 794,000 ft. 796,000 ft. 798,000 ft. 800,000 ft. 802,000 ft. 804,000 ft. 806,000 ft. 808,000 ft. 810,000 ft. 812,000 ft. 814,000 ft. 816,000 ft. 818,000 ft. 820,000 ft. 822,000 ft. 824,000 ft. 826,000 ft. 828,000 ft. 830,000 ft. 832,000 ft. 834,000 ft. 836,000 ft. 838,000 ft. 840,000 ft. 842,000 ft. 844,000 ft. 846,000 ft. 848,000 ft. 850,000 ft. 852,000 ft. 854,000 ft. 856,000 ft. 858,000 ft. 860,000 ft. 862,000 ft. 864,000 ft. 866,000 ft. 868,000 ft. 870,000 ft. 872,000 ft. 874,000 ft. 876,000 ft. 878,000 ft. 880,000 ft. 882,000 ft. 884,000 ft. 886,000 ft. 888,000 ft. 890,000 ft. 892,000 ft. 894,000 ft. 896,000 ft. 898,000 ft. 900,000 ft. 902,000 ft. 904,000 ft. 906,000 ft. 908,000 ft. 910,000 ft. 912,000 ft. 914,000 ft. 916,000 ft. 918,000 ft. 920,000 ft. 922,000 ft. 924,000 ft. 926,000 ft. 928,000 ft. 930,000 ft. 932,000 ft. 934,000 ft. 936,000 ft. 938,000 ft. 940,000 ft. 942,000 ft. 944,000 ft. 946,000 ft. 948,000 ft. 950,000 ft. 952,000 ft. 954,000 ft. 956,000 ft. 958,000 ft. 960,000 ft. 962,000 ft. 964,000 ft. 966,000 ft. 968,000 ft. 970,000 ft. 972,000 ft. 974,000 ft. 976,000 ft. 978,000 ft. 980,000 ft. 982,000 ft. 984,000 ft. 986,000 ft. 988,000 ft. 990,000 ft. 992,000 ft. 994,000 ft. 996,000 ft. 998,000 ft. 1000,000 ft. 1002,000 ft. 1004,000 ft. 1006,000 ft. 1008,000 ft. 1010,000 ft. 1012,000 ft. 1014,000 ft. 1016,000 ft. 1018,000 ft. 1020,000 ft. 1022,000 ft. 1024,000 ft. 1026,000 ft. 1028,000 ft. 1030,000 ft. 1032,000 ft. 1034,000 ft. 1036,000 ft. 1038,000 ft. 1040,000 ft. 1042,000 ft. 1044,000 ft. 1046,000 ft. 1048,000 ft. 1050,000 ft. 1052,000 ft. 1054,000 ft. 1056,000 ft. 1058,000 ft. 1060,000 ft. 1062,000 ft. 1064,000 ft. 1066,000 ft. 1068,000 ft. 1070,000 ft. 1072,000 ft. 1074,000 ft. 1076,000 ft. 1078,000 ft. 1080,000 ft. 1082,000 ft. 1084,000 ft. 1086,000 ft. 1088,000 ft. 1090,000 ft. 1092,000 ft. 1094,000 ft. 1096,000 ft. 1098,000 ft. 1100,000 ft. 1102,000 ft. 1104,000 ft. 1106,000 ft. 1108,000 ft. 1110,000 ft. 1112,000 ft. 1114,000 ft. 1116,000 ft. 1118,000 ft. 1120,000 ft. 1122,000 ft. 1124,000 ft. 1126,000 ft. 1128,000 ft. 1130,000 ft. 1132,000 ft. 1134,000 ft. 1136,000 ft. 1138,000 ft. 1140,000 ft. 1142,000 ft. 1144,000 ft. 1146,000 ft. 1148,000 ft. 1150,000 ft. 1152,000 ft. 1154,000 ft. 1156,000 ft. 1158,000 ft. 1160,000 ft. 1162,000 ft. 1164,000 ft. 1166,000 ft. 1168,000 ft. 1170,000 ft. 1172,000 ft. 1174,000 ft. 1176,000 ft. 1178,000 ft. 1180,000 ft. 1182,000 ft. 1184,000 ft. 1186,000 ft. 1188,000 ft. 1190,000 ft. 1192,000 ft. 1194,000 ft. 1196,000 ft. 1198,000 ft. 1200,000 ft. 1202,000 ft. 1204,000 ft. 1206,000 ft. 1208,000 ft. 1210,000 ft. 1212,000 ft. 1214,000 ft. 1216,000 ft. 1218,000 ft. 1220,000 ft. 1222,000 ft. 1224,000 ft. 1226,000 ft. 1228,000 ft. 1230,000 ft. 1232,000 ft. 1234,000 ft. 1236,000 ft. 1238,000 ft. 1240,000 ft. 1242,000 ft. 1244,000 ft. 1246,000 ft. 1248,000 ft. 1250,000 ft. 1252,000 ft. 1254,000 ft. 1256,000 ft. 1258,000 ft. 1260,000 ft. 1262,000 ft. 1264,000 ft. 1266,000 ft. 1268,000 ft. 1270,000 ft. 1272,000 ft. 1274,000 ft. 1276,000 ft. 1278,000 ft. 1280,000 ft. 1282,000 ft. 1284,000 ft. 1286,000 ft. 1288,000 ft. 1290,000 ft. 1292,000 ft. 1294,000 ft. 1296,000 ft. 1298,000 ft. 1300,000 ft. 1302,000 ft. 1304,000 ft. 1306,000 ft. 1308,000 ft. 1310,000 ft. 1312,000 ft. 1314,000 ft. 1316,000 ft. 1318,000 ft. 1320,000 ft. 1322,000 ft. 1324,000 ft. 1326,000 ft. 1328,000 ft. 1330,000 ft. 1332,000 ft. 1334,000 ft. 1336,000 ft. 1338,000 ft. 1340,000 ft. 1342,000 ft. 1344,000 ft. 1346,000 ft. 1348,000 ft. 1350,000 ft. 1352,000 ft. 1354,000 ft. 1356,000 ft. 1358,000 ft. 1360,000 ft. 1362,000 ft. 1364,000 ft. 1366,000 ft. 1368,000 ft. 1370,000 ft. 1372,000 ft. 1374,000 ft. 1376,000 ft. 1378,000 ft. 1380,000 ft. 1382,000 ft. 1384,000 ft. 1386,000 ft. 1388,000 ft. 1390,000 ft. 1392,000 ft. 1394,000 ft. 1396,000 ft. 1398,000 ft. 1400,000 ft. 1402,000 ft. 1404,000 ft. 1406,000 ft. 1408,000 ft. 1410,000 ft. 1412,000 ft. 1414,000 ft. 1416,000 ft. 1418,000 ft. 1420,000 ft. 1422,000 ft. 1424,000 ft. 1426,000 ft. 1428,000 ft. 1430,000 ft. 1432,000 ft. 1434,000 ft. 1436,000 ft. 1438,000 ft. 1440,000 ft. 1442,000 ft. 1444,000 ft. 1446,000 ft. 1448,000 ft. 1450,000 ft. 1452,000 ft. 1454,000 ft. 1456,000 ft. 1458,000 ft. 1460,000 ft. 1462,000 ft. 1464,000 ft. 1466,000 ft. 1468,000 ft. 1470,000 ft. 1472,000 ft. 1474,000 ft. 1476,000 ft. 1478,000 ft. 1480,000 ft. 1482,000 ft. 1484,000 ft. 1486,000 ft. 1488,000 ft. 1490,000 ft. 1492,000 ft. 1494,000 ft. 1496,000 ft. 1498,000 ft. 1500,000 ft. 1502,000 ft. 1504,000 ft. 1506,000 ft. 1508,000 ft. 1510,000 ft. 1512,000 ft. 1514,000 ft. 1516,000 ft. 1518,000 ft. 1520,000 ft. 1522,000 ft. 1524,000 ft. 1526,000 ft. 1528,000 ft. 1530,000 ft. 1532,000 ft. 1534,000 ft. 1536,000 ft. 1538,000 ft. 1540,000 ft. 1542,000 ft. 1544,000 ft. 1546,000 ft. 1548,000 ft. 1550,000 ft. 1552,000 ft. 1554,000 ft. 1556,000 ft. 1558,000 ft. 1560,000 ft. 1562,000 ft. 1564,000 ft. 1566,000 ft. 1568,000 ft. 1570,000 ft. 1572,000 ft. 1574,000 ft. 1576,000 ft. 1578,000 ft. 1580,000 ft. 1582,000 ft. 1584,000 ft. 1586,000 ft. 1588,000 ft. 1590,000 ft. 1592,000 ft. 1594,000 ft. 1596,000 ft. 1598,000 ft. 1600,000 ft. 1602,000 ft. 1604,000 ft. 1606,000 ft. 1608,000 ft. 1610,000 ft. 1612,000 ft. 1614,000 ft. 1616,000 ft. 1618,000 ft. 1620,000 ft. 1622,000 ft. 1624,000 ft. 1626,000 ft. 1628,000 ft. 1630,000 ft. 1632,000 ft. 1634,000 ft. 1636,000 ft. 1638,000 ft. 1640,000 ft. 1642,000 ft. 1644,000 ft. 1646,000 ft. 1648,000 ft. 1650,000 ft. 1652,000 ft. 1654,000 ft. 1656,000 ft. 1658,000 ft. 1660,000 ft. 1662,000 ft. 1664,000 ft. 1666,000 ft. 1668,000 ft. 1670,000 ft. 1672,000 ft. 1674,000 ft. 1676,000 ft. 1678,000 ft. 1680,000 ft. 1682,000 ft. 1684,000 ft. 1686,000 ft. 1688,000 ft. 1690,000 ft. 1692,000 ft. 1694,000 ft. 1696,000 ft. 1698,000 ft. 1700,000 ft. 1702,000 ft. 1704,000 ft. 1706,000 ft. 1708,000 ft. 1710,000 ft. 1712,000 ft. 1714,000 ft. 1716,000 ft. 1718,000 ft. 1720,000 ft. 1722,000 ft. 1724,000 ft. 1726,000 ft. 1728,000 ft. 1730,000 ft. 1732,000 ft. 1734,000 ft. 1736,000 ft. 1738,000 ft. 1740,000 ft. 1742,000 ft. 1744,000 ft. 1746,000 ft. 1748,000 ft. 1750,000 ft. 1752,000 ft. 1754,000 ft. 1756,000 ft. 1758,000 ft. 1760,000 ft. 1762,000 ft. 1764,000 ft. 1766,000 ft. 1768,000 ft. 1770,000 ft. 1772,000 ft. 1774,000 ft. 1776,000 ft. 1778,000 ft. 1780,000 ft. 1782,000 ft. 1784,000 ft. 1786,000 ft. 1788,000 ft. 1790,000 ft. 1792,000 ft. 1794,000 ft. 1796,000 ft. 1798,000 ft. 1800,000 ft. 1802,000 ft. 1804,000 ft. 1806,000 ft. 1808,000 ft. 1810,000 ft. 1812,000 ft. 1814,000 ft. 1816,000 ft. 1818,000 ft. 1820,000 ft. 1822,000 ft. 1824,000 ft. 1826,000 ft. 1828,000 ft. 1830,000 ft. 1832,000 ft. 1834,000 ft. 1836,000 ft. 1838,000 ft. 1840,000 ft. 1842,000 ft. 1844,000 ft. 1846,000 ft. 1848,000 ft. 1850,000 ft. 1852,000 ft. 1854,000 ft. 1856,000 ft. 1858,000 ft. 1860,000 ft. 1862,000 ft. 1864,000 ft. 1866,000 ft. 1868,000 ft. 1870,000 ft. 1872,000 ft. 1874,000 ft. 1876,000 ft. 1878,000 ft. 1880,000 ft. 1882,000 ft. 1884,000 ft. 1886,000 ft. 1888,000 ft. 1890,000 ft. 1892,000 ft. 1894,000 ft. 1896,000 ft. 1898,000 ft. 1900,000 ft. 1902,000 ft. 1904,000 ft. 1906,000 ft. 1908,000 ft. 1910,000 ft. 1912,000 ft. 1914,000 ft. 1916,000 ft. 1918,000 ft. 1920,000 ft. 1922,000 ft. 1924,000 ft. 1926,000 ft. 1928,000 ft. 1930,000 ft. 1932,000 ft. 1934,000 ft. 1936,000 ft. 1938,000 ft. 1940,000 ft. 1942,000 ft. 1944,000 ft. 1946,000 ft. 1948,000 ft. 1950,000 ft. 1952,000 ft. 1954,000 ft. 1956,000 ft. 1958,000 ft. 1960,000 ft. 1962,000 ft. 1964,000 ft. 1966,000 ft. 1968,000 ft. 1970,000 ft. 1972,000 ft. 1974,000 ft. 1976,000 ft. 1978,000 ft. 1980,000 ft. 1982,000 ft. 1984,000 ft. 1986,000 ft. 1988,000 ft. 1990,000 ft. 1992,000 ft. 1994,000 ft. 1996,000 ft. 1998,000 ft. 2000,000 ft. 2002,000 ft. 2004,000 ft. 2006,000 ft. 2008,000 ft. 2010,000 ft. 2012,000 ft. 2014,000 ft. 2016,000 ft. 2018,000 ft. 2020,000 ft. 2022,000 ft. 2024,000 ft. 2026,000 ft. 2028

ENGINEERS

Bausch & Lomb

A fully subdivided plant in the optical industry. We require New York residents to qualify immediately for electronic mechanical systems design. Degree holders or computer engineers are considered automatically with a flexible schedule of hours and an excellent salary for setting up your own time. Send your resume and application to Bausch & Lomb.

PHYSICISTS

Ph.D. or M.S. with experience in the field of particle physics. Research and development in particle physics. Research and development in particle physics.

ELECTRICAL ENGINEERS

B.S. with M.S. desirable. Power and energy systems experience in design and development. Research and development in power systems. Research and development in power systems.

MECHANICAL ENGINEERS

B.S. with M.S. desirable. Mechanical design and development in mechanical systems. Research and development in mechanical systems. Research and development in mechanical systems.

B.S. with M.S. desirable and a license in mechanical engineering. Research and development in mechanical engineering. Research and development in mechanical engineering.

INSTRUMENT ENGINEERS

Ph.D. with M.S. desirable. Instrumentation and control systems design and development. Research and development in instrumentation. Research and development in instrumentation.

OPTICAL ENGINEERS

Ph.D. with M.S. desirable. Optical design and development in optical systems. Research and development in optical systems. Research and development in optical systems.

LIVE IN BOCHISTON

Bochiston is located in the heart of the Boston area. We require New York residents to qualify immediately for electronic mechanical systems design. Degree holders or computer engineers are considered automatically with a flexible schedule of hours and an excellent salary for setting up your own time. Send your resume and application to Bausch & Lomb.

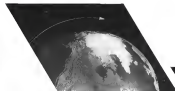
YOU ARE INVITED

To attend your local B & L in New York City.

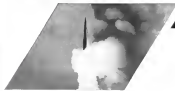
Bausch & Lomb

12 South Street
Rochester 2, New York

Engineers Mathematicians Physicists



THIS IS YOUR PROFESSIONAL APPLICATION



Immediate Dyna Soar and Minuteman openings

Imaginative, technically creative engineers and scientists interested in participating in the advancement of space-age technologies will find unique opportunities at Boeing. Such advanced weapon systems at Boeing as Minuteman, and the Dyna Soar boost-glide vehicle, offer challenging — and deeply rewarding — assignments in a broad spectrum of professional disciplines.

FORM... FILL IN AND MAIL TODAY

There are openings at Boeing, now, in your area of interest, and at the level you require for satisfaction and advancement. We'd like to discuss these assignments in the light of your career plans. To expedite this discussion, we invite you to fill in and mail the professional application form at the right.

BOEING

AVIATION WEEK, October 31, 1958

RETURN TO: MR. W. E. EVANS
BOEING AIRPLANE COMPANY
P. O. BOX 3707
SEATTLE 24, WASHINGTON

PROFESSIONAL PORTION APPLICATION
(All replies held in strict confidence)

Date of this Application _____

Name _____
LAST FIRST MIDDLE SURNAME INITIALS

Social Security No. _____

Present Address _____
NO. STREET

CITY STATE ZIP

Telephone No. _____

Dr. _____ Mr. _____ Mrs. _____ Miss _____

Male _____ Female _____ Married _____ Single _____

No. of Children _____ Other Dependents _____

I. S. Veteran _____ Entry Date _____

Discharge Date _____

Type of Discharge _____

Spouse's Maiden Name _____

Employer _____

Previous Boeing Employee? _____

If the answer to following three questions is "Yes," explain on supplementary sheet:

1) Have you any physical defects? _____

2) Have you ever been arrested (except traffic and possession)? _____

3) Have you ever received disability or accident compensation? _____

TURN PAGE →

EDUCATION

College and Location	Dates Attended	Degree and Major
1		
2		

EMPLOYMENT HISTORY

Place, Dates and Address	How Far From Home (in Miles)	Employment Dates
1		
2		
3		
4		
5		

REFERENCES Give full names, occupations and addresses. Professional (previous experience preferred)

1	
2	
Character (other than references or former employer)	
1	
2	

LIST TYPE OF WORK PREFERRED UPON EMPLOYMENT

--

Have you ever been cleared for classified military information? ☐ If yes, give date, level and company

May we contact your former and present employer prior to completion of employment negotiation? Yes ☐ No ☐
If "yes," if authorized, without liability, the release of all employment and personal information

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

REPLY TO MR. W. B. EVANS
BOEING AIRPLANE COMPANY
P. O. BOX 370
SEATTLE 26, WASHINGTON



Working on Hybrid Beam Source

Matching the career advantages at Boeing are the hands-on learning advantages of the Pacific Northwest. This unoccupied region offers an ideal environment for its mild year-round climate and its plentiful recreation facilities. Snow-capped ranges, sparkling mountain streams, lakes, forested camping and golf areas are within minutes of Seattle.



Sailing on Glacial Lake Poughkeepsie in Seattle

Seattle has the highest percentage boat ownership in the country. Just 15 minutes, short, and water takes you to the sea. Seattle, in addition, is located on Puget Sound, which offers hundreds of miles of protected salt water for sailing, fishing, boating. The Seattle area is famous, too, for fine western farms, world-class educational and cultural institutions and beautiful outdoor life that are yours for the whole family.

An important new wave of activity based on exciting new projects is creating

Unusual Openings for Electronic Engineers at HAMILTON STANDARD

Missiles & Space Systems Department

This is a dynamic new force in space technology! Present contracts include studies for a complete ballistic missile defense system . . . a new generation ICBM . . . an advanced launch vehicle recovery system. These are supervisory positions for well-learned

• **ELECTRONIC GUIDANCE:** BS in Physics or Electrical Engineering, 20-22 years experience in Electronic Systems and Computer Systems. Skilled in Electronic Navigation Aids, Applied Math, Computer Systems.

• **INTERNAL GUIDANCE:** BS in Physics or Math with 10-12 years experience in Applied Mathematics and Computer Techniques. Skilled in Inertial Navigation Systems, Systems Analysis and Synthesis, Laplace Transform Techniques, Computer Systems.

• **INSTRUMENTS:** MS in Physics or Electrical Engineering with 20-22 years experience in Electronic Systems and Sub-Systems. Skilled in Radar, Infrared Detectors, Optical, Ultrasonic, Techniques, Systems Integration, Communications and Computer Communications.

• **DATA PROCESSING:** BS in Physics/Electrical Engineering with 10-12 years experience in Electronic Sub-Systems, Computer Theory and Practice. Background in Computer Logic, Computer Systems and Components, Cryptology, Navstar Theory.

• **CONTROL SYSTEMS:** BS in Physics, Aerodynamics, or Math with 14-18 years experience in Aerodynamics, Applied Math, Skilled in Stability Analysis, Mathematical Modeling, Transfer Functions, Servomechanism Theory, Computer Design.

• **GUIDANCE AND CONTROL:** MS in Physics, Math or Aeronautics with 12-15 years experience in Aerodynamics, Aerodynamics, Computer Techniques. Skilled in Stability Analysis, Servomechanism, Servomechanism, Systems Analysis, Control Systems.

• **COMMUNICATIONS:** BS in Electrical Engineering or Physics with 10-12 years experience in Electronic Engineering for Communications, Communication Theory, Radar Interference and Recovery, Radar Engineering, Communications and Counter-communications, Security Coding.

Enjoy life in the beautiful Connecticut countryside with its good schools, short commuting and easy access to New York and Boston. Company-paid graduate study program . . . generous relocation allowance. Write in confidence to Mr. Richard A. Folger, Dept. 3.

HAMILTON STANDARD
DIVISION OF UNITED AIRCRAFT CORPORATION
3 BRADLEY FIELD ROAD, WINDSOR LOCKS, CONNECTICUT

AVIATION WEEK, October 21, 1962

Electronic Department

This fast-expanding and autonomous department has the following key openings:

• **EMERGENCY CONVERSION ENGINEERS:** for static location, conversion and frequency changes for military, space and commercial applications. Minimum 4 years experience with design development background in aircraft and industrial power supplies and processing systems.

Be familiar with as many of the following as possible: switching characteristics of transistors, offset control mechanisms and four layer diodes, transistors, diodes and power—filters, signal level and power—output mechanisms—polyphase circuits—heat transfer—packaging—power processing system specifications.

• **DIGITAL COMPUTER SYSTEMS ENGINEERS:** Electronics, Math at Physics degree and at least five years experience in design, development and analysis of digital circuits or computers. Be familiar with computer organization, logical design, statistical theory of induction and/or coprocessors, pulsed data systems and switching circuits. Recent edge of magnetic core or solid state devices desirable.

Electronic Beam Machine Technology

is developing an entirely new capability at Hamilton Standard. Opportunity unlimited for:

• **RESEARCH PHYSICIST** with at least 2 years R&D experience in semi-conductor and tube devices. Ph.D. preferred. Will conduct fundamental studies of existing beam technology related to new processes and applications in semi-conductor or tube instrumentation.

• **RESEARCH ENGINEER:** Physics or Electronics with at least 2 years R&D experience in mechanism processes involving manufacture of electronic or semi-conductor or nuclear products. Desires individual with diverse background, particularly heavy in high vacuum technology to conduct studies involving substantial progress in electron beam machine technology.

• **DEVELOPMENT TEST ENGINEER:** Electronics for development work on electron components of electron beam equipment. Should have thorough knowledge of at least one high voltage vacuum tube, electronic circuits, electronic circuits, electronic beam formation and control, data processing techniques.

• **TEST ENGINEER:** . . . electronic, electrical and mechanical.

IMPORTANT
PROGRESS TOWARD ADVANCED
AIRCRAFT
—THROUGH NUCLEAR POWER—



*—the flight vehicle which can live in the air
as easily and confidently as a ship lives in the sea—
will be powered by a nuclear reactor, the only source
of energy which can provide virtually unlimited range
and endurance for aircraft, for high altitude or on
the deck, long range military air missions.*

When the program to produce such a nuclear propulsion system was started at General Electric in May, 1951, reports there felt that the project might take twenty years.

But today, little more than nine years later, the Aircraft Nuclear Propulsion Department of General Electric has developed and demonstrated the basic technology required to build and fly a high performance aircraft nuclear propulsion system.

During the 9-year span of effort, General Electric engineers and scientists have achieved major breakthroughs in reactor technology, shielding techniques, high temperature nuclear materials, specialized controls capable of functioning reliably in a high density radiation environment, and in other areas.

One of these technical achievements is described in the right in capsule article form. In accordance with announcements already concerning official advances at the Aircraft Nuclear Propulsion Dept. at General Electric will be discussed.

**ADVANCES IN NUCLEAR
SHIELDING TECHNIQUES**

As the shield is the largest weight item in the propulsion system, major effort has been applied to develop means to reduce weight and shield size. The shield of the Aircraft Nuclear Propulsion system.

The shield of the propulsion system was not developed until the shield was developed. The shield of the propulsion system was not developed until the shield was developed. The shield of the propulsion system was not developed until the shield was developed.

One of the major goals required was the development of a shield which would be as light as possible while still providing the shielding required for the power plant and the crew compartment. This concept called for the use of the most efficient shielding materials available.

The shield was not developed until the shield was developed. The shield of the propulsion system was not developed until the shield was developed. The shield of the propulsion system was not developed until the shield was developed.

Various theoretical and experimental techniques have been used to determine the most efficient shielding materials available. The shield of the propulsion system was not developed until the shield was developed.

The nuclear shield must be as light as possible while still providing the shielding required for the power plant and the crew compartment. This concept called for the use of the most efficient shielding materials available.

Opportunities and Index for Engineers and Scientists from many disciplines in order to provide solutions of a variety of sophisticated problems pertaining to the final development stage of General Electric's nuclear propulsion system for high performance aircraft.

Discussions available in both Cincinnati, Ohio and Idaho Falls, Idaho for Metallurgical, Chemical, Mechanical, Electrical and Chemical Engineers, Nuclear and Solid State Physicists, Physical Scientists.

If you have an interest, no qualifications, in any of these areas, please write in confidence to Mr. George H. Harnberger, Manager, Personnel Personnel Room 647R.

AIRCRAFT NUCLEAR PROPULSION DEPARTMENT

GENERAL ELECTRIC

PH 308-122

CHICAGO, ILL. 60601

ADVERTISERS IN THIS ISSUE

AVIATION WEEK, OCTOBER 31, 1960

GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14

GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14

GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14

GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14
GENERAL ELECTRIC CORPORATION	14-16	WESTINGHOUSE ELECTRIC CORP.	14



**STRUCTURAL
DESIGN
ENGINEERS**

Two years engineering college plus experience desired. Will be engaged on wing and fuselage design.

**STRESS
ENGINEERS**

High stress design requirements necessitate extensive structural investigation of the factors of high temperatures and unconventional material loading. Stress engineers concerned with such structures will have the opportunity to utilize their technical knowledge to the fullest extent in the development of new aircraft designs. Experience plus degree preferred.

For more information please write to Mr. A. S. Bowman, Engineering Personnel, North American Aviation, Inc., Los Angeles 45, California.

THE LOS ANGELES DIVISION OF
NORTH AMERICAN AVIATION, INC.

CLIFTON PRECISION IS DELIVERING 28.5 LB. AUTOMATIC DEAD RECKONING NAVIGATIONAL SYSTEMS

UTILIZING DOPPLER INPUTS



AKH/1

These Sub-Monster Systems provide:

- Continuous Latitude/Longitude Present Position • Course and Remaining Distance to Destination • Course and Remaining Distance to Threat or Alternate Destination • Automatic Display of Wind Velocity and Direction • Steering Information • True Ground Track

YOU WILL WANT TO CONSIDER CPDC NAVIGATIONAL COMPUTERS BECAUSE:

THEY EXIST NOW—have been delivered to customers, exclusively tested and found to better the spec for accuracy and performance.



OFFER HIGHEST ACCURACY.

By a simple change of modules these systems may be adjusted to any aircraft from a hovering helicopter through a 320 knot submarine plane to a Mach 2 bomber or fighter plane. The same modular design permits use of future jet recovery and recovery aircraft to earth to be provided.

For full information write or telephone: Sales Dept. 5850 State Road, Street 101, P.O. Box 31800, Oak Ridge, TN 37831 or our Representatives.

CLIFTON PRECISION PRODUCTS CO., INC.
CLIFTON HEIGHTS, PA.



108° 00' W
20° 00' N

P.P.

DEST.

LETTERS

The Poor Passenger

Let read your column "Try the Four Passenger" (AW Oct. 31) also realizing from a West Coast trip via jet, at any air craft was down for maintenance.

I still "suffer" at what you represent, you describe an average "TBT" disaster flight as well as foreign schedules. At the same time, "Time to open, go by me—some time out, go by me."

J. E. HARRISON Jr.
Aerovis Owners and Pilot Area
Washington, D. C.

I was most interested and quite amazed with your column in the Oct. 3 issue of *Airman's World* concerning the Four Passenger. Don't try not to be prejudiced. I cannot help but agree that after completing a flight one wonders who the airlines are trying to serve—the passenger or a combination of the National Association of Airports and Old Man Comedian. After meeting a board at the Los Angeles International Air Terminal last month, we stayed in the baggage room for 25 min waiting to give someone the check check. Finally we picked up our baggage and left. I suppose I could have taken someone else's part as only one out of the crew.

In reference to the flight of my travels, however, I am not a little bewildered at some of the personal details. Since I have not said that there for more than one plane to have entered simultaneously and have some material for down position then for efficiency. I know that the one thing I am interested in when I make a trip is to find a place to park at time is possible to the airline. I am interested in, and then get out as fast as possible without being treated in the airports. The relation to the airline, design and parking problem seems to me less difficult than I have read. Why not design a tunnel terminal building with several gates, the limited and automatic travel parking lot at the center? Expansion could be vertical and the main building entrance of current would be underground.

The bus lane and sidewalk seem to have solved, in part, these main problems with "chaperone" type Mark II standard plane to point type. Why can't the airport be designed, including the arrival and flight blocks would be successful since they are monthly.

Don Williams V. Gonzalez, MSVR
Nard, Wade & Associates Center
P. M. Vega City

Your editorial in the Oct. 3 issue of *Airman's World* on airport problems has the nail on the head.

As the editor of the leading aviation publication, your words are certain to get at heart and passengers everywhere will be relieved to see the industry bringing attention to the problem.

O. L. Dwyer
Manager, Electronic Service Division
Raytheon Co.
Bedford, Mass.

Article in *World* addresses the problem of air travel in the same sense as the industry's editorial releases address. The article in the *Editor, Airman's World*, Oct. 31, 1968, New York 36, N. Y. 10017, is a good example of the industry's attitude toward the problem. It is a good example of the industry's attitude toward the problem. It is a good example of the industry's attitude toward the problem.

Synchronous Satellite

Reference is made to one article entitled, "Radio Satellite System" (AW Oct. 31, 1968) in the Sept. 3 (p. 35) issue of *Airman's World*.

The statement is made both in the text and under one of the illustrations that a synchronous satellite orbits the earth every 24 hr. Therefore a satellite of this type whose orbit is inclined to the equator, remains over the same spot on the earth.

MAURICE SANCHEZ
Technical Operations Branch
Aeronautics Division
Traffic & Development Section
AEC

Weight Problems: AFB Ohio
(Reader Service is correct. The synchronous satellite orbits the equator once every 24 hr. regardless of its orbital inclination.—Ed.)

Pulse Radiation

Thank you very much for the report about the nuclear pulse radiation in the *Airman's World* section of the Aug. 5 issue (p. 15) of *Airman's World*. The information given in the article, coupled with the fact that the radiation is not as dangerous as the report, and the fact that the Air Force, at the Air Force Special Weapons Center at Altus, Okla., has helped to point out the need for further understanding of ionizing radiation effects.

We feel that this is an area where much experimental work remains to be done and where considerable challenge is presented to physicists and other scientists working in the fields of solid state and electronics. In addition, the increasing importance of having good, reliable electronic tools to permit experimental work in these areas to be done safely. In this regard we would like to call your attention to the work of the Radiation Effects Research Group, which has been designed by Aeronautics International to make that unusual radiation testing may be performed in a more natural and safe manner.

This pulse source is known as the Solid State Pulse Generator (SSPG). It is based on the same basic concept as the solid state electronic circuit, which has been designed, constructed and installed by Aeronautics International and is currently being in various parts of the world. The SSPG will produce pulses of 100 microseconds and 100 V of positive voltage, with total energies of 5.00 megajoules, pulse widths of 100 ns and pulse rates of approximately 1000 pulses per second.

In addition to favorable nuclear radiation characteristics, the homogeneous nature of the radiation of synchronous satellite and safety.

Extensive safety investigations, conducted by AI under the AEC-sponsored program "Radio Experiments of Space Systems," have conclusively demonstrated that point. During these tests, the system was subjected to a great deal of test, but one with success. These tests fully demonstrated the safety characteristics of the SSPG, and the results showed that the system is safe in that there would be no damage or destruction to any of the homogeneous thermal environment.

We are confident of the ability of the SSPG to meet the general requirements of pulse radiation testing. In addition, the fact that the system is safe in that there would be no damage or destruction to any of the homogeneous thermal environment.

W. M. HARRISON
Aeronautics International Division
North American Aviation, Inc.
Cincinnati, Ohio

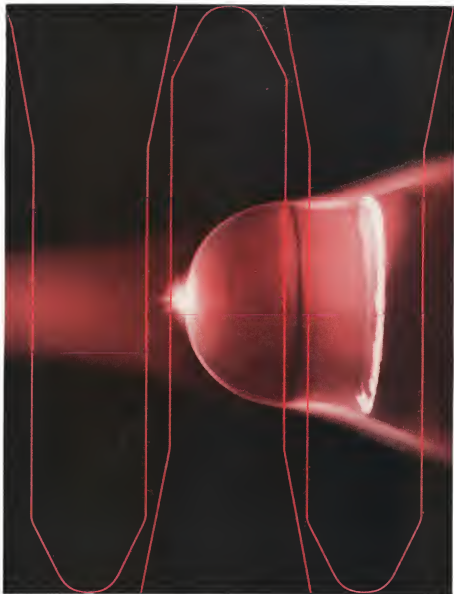
Nerve Gases

The article in the Sept. 3 issue of *Airman's World*—"Nerve Gases: Nerve Gas Development" (p. 31)—indicates the need for a new philosophy in weapon development. Until now we have been based on the "kill" or "morbidity" destruction and damage concept. For a nation as advanced in technology as ours, this concept is obsolete. The concept of "morbidity" is obsolete.

When we consider the effects of nerve gases and the fact that the nerve gases are not as dangerous as the report, and the fact that the Air Force, at the Air Force Special Weapons Center at Altus, Okla., has helped to point out the need for further understanding of ionizing radiation effects.

We feel that this is an area where much experimental work remains to be done and where considerable challenge is presented to physicists and other scientists working in the fields of solid state and electronics. In addition, the increasing importance of having good, reliable electronic tools to permit experimental work in these areas to be done safely. In this regard we would like to call your attention to the work of the Radiation Effects Research Group, which has been designed by Aeronautics International to make that unusual radiation testing may be performed in a more natural and safe manner.

This pulse source is known as the Solid State Pulse Generator (SSPG). It is based on the same basic concept as the solid state electronic circuit, which has been designed, constructed and installed by Aeronautics International and is currently being in various parts of the world. The SSPG will produce pulses of 100 microseconds and 100 V of positive voltage, with total energies of 5.00 megajoules, pulse widths of 100 ns and pulse rates of approximately 1000 pulses per second.



Blasting new materials to make missile nose cones. The first ICBM nose cone ever to be recovered after flight was protected by a new, high-temperature material. Its name: Avcoite. Its construction: specially reinforced ceramic. Avcoite was the first of a family of new heat-shielding materials. They were developed for re-entering nose cones and satellites by Avco's Research and Advanced Development Division. Newest addition to this materials family is Avcoat, a plastic heat-shield here ablating smoothly in a hydrogen-oxygen jet simulating satellite re-entry temperatures.

UNUSUAL CAREER OPPORTUNITIES FOR QUALIFIED SCIENTISTS AND ENGINEERS... WRITE AVCO TODAY.

Avco

AVCO CORPORATION, 750 THIRD AVENUE, NEW YORK 17, NEW YORK